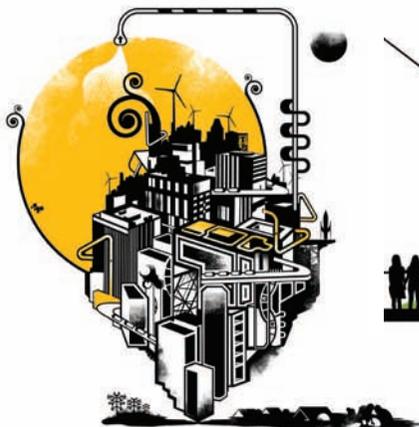


climate futures

responses to climate change in 2030

October 2008

efficiency first



redefining progress



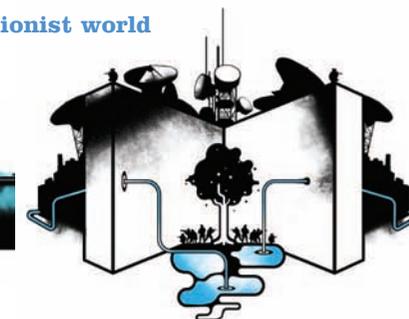
service transformation



environmental war economy



protectionist world



Forum for the Future – the sustainable development charity – works in partnership with leading organisations in business and the public sector. Our vision is of business and communities thriving in a future that is environmentally sustainable and socially just. We believe that a sustainable future can be achieved, that it is the only way business and communities will prosper, but that we need bold action now to make it happen. We play our part by inspiring and challenging organisations with positive visions of a sustainable future; finding innovative, practical ways to help realise those visions; training leaders to bring about change; and sharing success through our communications.

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introduction

The year is 2030. Global supply chains are shrinking. The US president has called for the UN to be dismantled. Globalisation is in retreat, trade barriers are rising and conflicts over water, food and energy are breaking out. It's a far cry from the heady days of 2012, when an ambitious post-Kyoto agreement on climate change was signed, to great fanfare.

Or picture this: it's 2030 and major companies are adopting 'consumer wellbeing' as a performance metric. South Korea has renounced the idea of economic growth, as spirituality and religion undergo a historic resurgence, allied with the mantra of 'live simply and slowly'. Despite the ravages of climate change – or because of them – communities are coming together.

Or how about this? It's 2030 and environmental refugees now make up 18 per cent of the population of New Zealand. With major restrictions on international freight, space is one of the country's most tradable assets. The world is coming together and organising a response to climate change, but it's late in the day, and drastic measures are being taken, pushing economies to their very limits.

We know more and more about the environmental impacts of climate change every day. Models can project temperature rises and rainfall trends at a regional, and soon even national, level. Our understanding of complex climate feedback loops is advancing quickly. But we know much less about how people, communities, countries and economies will respond to climate change. What will our climate-changing world look like in 2030? Will climate change unite the world or divide it? Will we be on the way to solving climate change, or will the challenges be too much for us? What can business contribute to the solutions?

These questions are impossible to answer definitively, but we can explore *possible* answers, and discuss what those different answers might depend on. Exploring the future in this way could help us to prepare for a wide range of possibilities. It could even lead to insights that help us to shape the future.

That's the thinking behind *Climate Futures*. In this report, we describe five different worlds all set in 2030, each responding to climate change in different ways.

The scenarios are based on wide research and consultation and a rigorous methodology. They aren't predictions for the future, and we don't think that one scenario is necessarily more likely than another. But we do hope that they present elements of the possible future in a plausible and convincing way, and stimulate and challenge the reader.

Putting the scenarios together is not an academic exercise. We want people to think when they read them: what can I do to plan for this? We want the scenarios to open up ideas for new products or services that could succeed in the future, and inform business strategies that will help the world to mitigate climate change or make the world more resilient to cope with climate change. The scenarios are tools to help strategists consider and prepare for the changes that might come, and to think about how their organisation can support moves towards more positive futures.

Our report has three main sections. Firstly, we explore the factors that are likely to define the human response to climate change. Then we describe our five scenarios in detail. Finally, we step back from the scenarios and explore their implications for business, and indeed anyone interested or involved in the challenge of climate change.

This report is 76 pages long because we felt there was a lot to say about the future human response to climate change. But we summarise the three sections in the executive summary below.

executive summary

***Climate Futures* explores different possible responses we could see to climate change in the years to 2030: five different scenarios, all very different from today and all dealing with climate change in radically different ways. Which is the most likely future? We don't know, but we think that all are possible, and reality is likely to reflect aspects of all of them. They are based on a review of the current science and from consultation with a wide range of experts on climate change and its impacts.**

The scenarios focus on the social, political, economic and psychological aspects of climate change. Climate change is not just an environmental problem – we will need to think across disciplines, in all sectors and globally if we are going to deal with it effectively. Businesses should not think about having a 'climate change strategy' but a strategy that will work in a complex and uncertain world dominated by climate change: a strategy for the 'climate change years'.

Climate Futures is a collaboration between HP Labs and Forum for the Future. We have put extra thought into the implications of the scenarios for business and for the ICT industry, but they are tools that any organisation can use for strategic planning or product innovation.

factors shaping the future

We have created seven categories for the factors that will shape the future response to climate change:

the direct impacts of climate change

There are some details about climate change we don't know yet – how quickly it will happen, exactly where different impacts will be felt or if we are nearing a tipping point that irreversibly changes our climate system forever. But climate change is a scientific certainty. We know that over the medium and long term

temperatures will rise, the frequency of storms will increase and rainfall patterns will shift, dousing some areas and leaving other areas parched. Ecosystems will be destabilised, ice caps and glaciers will melt and sea levels will rise. These impacts form the backdrop to all of our scenarios.

public attitudes to climate change

How climate change is perceived by the public at large will have a profound influence over what governments, businesses and other institutions feel they can do. Attitudes will be informed by how climate change science is communicated, and how the issues are represented, discussed and responded to in public debate. Will people be willing to change their behaviour? Do they trust what the media says? How visible are the impacts of climate change, both environmental and in terms of human suffering? Different answers to these questions are explored in the scenarios.

how the business community responds

To what extent will businesses accept and promote the shift to a low-carbon economy? Will climate change be seen as an opportunity for new business as well as a risk to current models? There are a number of pathways for the future of business, each explored in a different scenario. There could be a renewed focus on efficiency and growing the economy to create the wealth to deal with climate change (as in our Efficiency First scenario). There could be a fundamental shift in business models towards a service economy (as in Service Transformation). Or there could be a values-shift that completely changes the role of business in society (Redefining Progress). The alternatives are that business becomes in effect an agency of government (Environmental War Economy) or fights for survival (Protectionist World).

the nature of the global economy

As this report is published, the global economy faces great uncertainty. Climate change will affect the economy at least as much as the 'credit crunch' and the world's response to climate change will depend on how the economy is set up. An economy that is globally very interconnected will have a different response to one that is regionalising. A partial retreat in globalisation is a very real prospect in the decades to come, and could lead to a decline in international cooperation.





We will also see the emergence of powerful new economies and economic blocs. The economic models adopted by the likes of China, India, Brazil and Russia will be critical in shaping the response to climate change.

the availability of natural resources

Climate change is far from the only environmental issue that the world will face in the years to 2030. We will also have to deal with worsening resource shortages, with the supply of energy a key variable. Energy policy may work with the grain of climate change policy, if it means that investment in renewable sources increases, or against it, if it makes coal irresistible. The availability of water, productive land, timber, marine fisheries and minerals could all falter and affect how the world responds to climate change. And against the backdrop of a rapidly expanding human population – another billion-and-a-half people on top of today's 6.7 billion – we could see environmental refugees in much larger numbers than today.

the political response, at a national and international level

The most immediate question in this area is whether there will be a successor to the Kyoto Protocol. We have found a very wide range of views on this topic in our expert interviews. In the medium term if there is no settlement, then the separate initiatives of countries and regions such as the European Union are all the more important. What priority will different countries give to climate change policy, and to what extent will other policy priorities conflict with it? Will policies be primarily market-based or more directly interventionist? What emphasis will be placed on changing citizen behaviour? Policy is one thing, and enforcement another – it is possible that laws are passed and treaties signed but not enforced, due perhaps to poor governance. Eventually, if policy on reducing emissions falters, will the priority shift to adaptation measures?

which technologies are developed and used

Finally, our research has shown that technology is an important shaper of the future response to climate change. To envisage possible futures, we needed to understand what new technologies might be developed and used that would help reduce greenhouse gas emissions, reduce the impact of climate change and help

the world adapt to a climate-changed world. We thought about how energy is produced; methods to capture and sequester carbon; technologies to intervene directly in the climate system (geo-engineering); ways to improve efficiency; low-carbon mobility solutions; and options for reducing or virtualising general consumption. The success of any of these will be determined by many factors, not just the availability of the technology. Levels of investment, the speed of technological development, the speed and extent of implementation, technical effectiveness and public acceptability of the technology are all important.

All of these issues are played out differently in our five *Climate Futures* scenarios.

five scenarios for 2030



efficiency first – *Rapid innovation in energy efficiency and novel technologies has enabled a low-carbon economy with almost no need for changes in lifestyle or business practice*

The power of innovation has revolutionised the economy. A high-tech, low-carbon transformation is delivering dramatic cuts in greenhouse gas emissions while managing to sustain economic growth. Across the world, innovative business solutions appear to sustain the insatiable demands of eight billion people to consume more, grow richer and live longer.

The result is an increasingly individualistic, consumerist and fast-moving world. High levels of economic growth in the global economy for decades have only been interrupted by relatively minor downturns related to the availability of resources, and growth in the global South has been particularly marked. But overall levels of growth mask a growing divide between rich and poor people.

The world has seemed close to overheating for years, but somehow keeps going

through developing novel efficiencies and more sophisticated ways of doing things, always adding to the complexity of systems. Some call this a golden age of technology and freedom, others call it a very shaky house of cards.

- Artificially-grown flesh feeds hundreds of millions of people.
- Massive desalination plants in the Middle East and North Africa soak up vast quantities of solar energy and irrigate the desert.
- Supercomputers advise governments on policy and businesses on strategy and even influence personal lifestyle choices – accurately testing ideas against virtual societies.
- Nanotechnology has developed to the point where ‘smart dust’ is used for real-time environmental monitoring, security and disaster relief.
- America’s eastern seaboard is protected from storms by eco-concrete walls that generate power from waves and tidal surges.



service transformation –

A high price of carbon has ushered in a revolution in how people’s needs are satisfied

Carbon is one of the most important and expensive commodities in the world today,

unleashing unprecedented levels of creativity across the global economy. Companies have rewritten their business models to meet underlying needs, often by selling services instead of products. This is a new type of consumerist world, one with a ‘share with your neighbour’ ethos.

Europe led the way with its Energy Independence Initiative, driven first by concerns over energy security. The continent’s successful new models in infrastructure and business have been exported around the world. Today, washing machines are too costly, so advanced collective laundry services are more popular. Individual car ownership is unaffordable and undesirable, but rent-a-bike and rent-a-car are booming and mass public transit is hugely successful. Rental

services – which offer maintenance and waste collection all-in-one – are widespread for electronic goods.

India is a service hub, which has prioritised the roll out of ‘zeta-broadband’ to its villages over and above investment in roads. The dramatic transformation in business has been painful for some, with rising unemployment in the old high-carbon sectors. The US legacy of individualism – from urban sprawl to cleantech innovation – has resulted in a comparative struggle to cope with stripping carbon out of its economy. Booming mega-cities are only just managing to cope and fuel poverty is a huge problem.

- NATO has defined breaking the 2020 Beijing Climate Change Agreement as an attack on all its members, to be defended by military force.
- Central Australia and Oklahoma have been abandoned due to water shortages. Climate change extremist parties clamour for compensation.
- Athletes stay at home in the world’s first Virtual Olympics – competing against each other in virtual space with billions of spectators.
- Specialist companies offer a ‘rent-a-molecule’ business, lending a material to a manufacturer for return at the end of the product’s life.
- Campaigns in China have created a new generation of patriotic vegetarians whose energy-efficient diet is cheap, tasty and popular.



redefining progress –

New priorities of ‘wellbeing’ and ‘quality of life’ are bubbling up across the world as more sustainable forms of living become established

This is a ‘wellbeing economy’ that highly values meaningful work, low-impact lifestyles, more time with family and friends, better health outcomes, creative educational experiences and a stronger sense of community. Countries prioritise economic and social resilience over the idea of economic growth.



During the global depression of 2009-18, new forms of living were born out of necessity. Individuals were forced to scale down consumption and prioritise meeting their immediate needs. Communities favoured local knowledge and looked to their own members to provide goods and services. As the world emerged from the depression, these new ways of living survived: from lower impact lifestyles to advanced networks that informally provide for needs at a local level.

This is not a post-capitalist society – people work, consume and profit in markets. But citizens view money as a means to different ends and active governments tightly regulate the economy. Nor do communities experience isolation cut off from the outside world. Mindsets are intensely connected worldwide through global communications – different cultures learn from one another, Eastern mindsets infuse with the West, and diverse faith communities find common cause in advocating simplified consumption patterns and more sustainable lives.

But happiness is not universal. ‘Free-riders’ – quick to abuse the goodwill of others – profit from collective agreements, plunder resources and exploit the vulnerable. Several large cities have set themselves up as ‘havens of real capitalism’ and some governments have adopted an aggressive ‘pro-growth’ stance. In the communities hit hardest by the depression, many poor and excluded people remain isolated, shunning offers of support in a daily struggle to survive.

- Countries compete to score highest in the World Bank’s Wellbeing Index. South Korea’s President promises ‘zero economic growth’ to focus resources on improving quality of life.
- In the US most people work 25 hours and do up to 10 hours voluntary work in their communities or online. The EU Working Time Directive sets a limit of 27.5 hours a week.
- ICT allows people to monitor their fitness, stress levels and emotional health and share details with friends. Empathy Engines are selling fast in China, allowing instantaneous sharing of emotions between dispersed families.

- Slower solutions are status symbols: labels proudly display how long products took to make.
- The mayor of Singapore scrutinises daily ‘hot spot maps’ of suicide rates and prescriptions for anti-depressants to direct real-time responses.

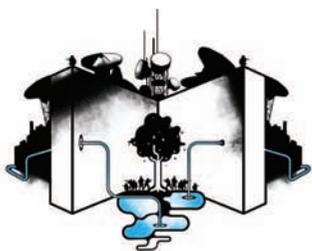


environmental war economy – *Tough measures have been adopted to combat climate change, pushing markets to the very limit of what they can deliver*

This is a world that woke up late to climate change. Efforts to broker a post-Kyoto agreement faltered, and instead different regions of the world pursued their own priorities. But as the environmental impacts began to worsen, the world started to come together. In 2017 a global pact was signed, but even so the global political community was forced into reactive strategies. Governments began to rely on hard policy to change how businesses worked and how people lived their lives. As time went on, the state took a stronger and stronger role, rationalising whole industry sectors to reduce their climate change impacts, and even putting ‘Carbon Monitors’ in people’s homes to watch their energy use.

Governments push markets to the very limit of what they can deliver. In different ways in different countries, economies have been forcibly re-orientated to focus on dealing with climate change, in much the same way as sometimes happens in times of war. But in most cases this has happened gradually, ratcheting up over time, with citizens surrendering control of their lives piecemeal rather than all at once, as trading regimes, international law, lifestyles and business have responded to the growing environmental crisis. And so in 2030, greenhouse gas emissions are beginning to decline, but the cost to individual liberty has been great.

- Licences are required to have children in some countries and awarded on a points system; climate-friendly behaviour earns extra points.
- Governments have banned personal car ownership and forced citizens to replace convector ovens with microwaves. Kettles and washing machines are automatically switched off when households exceed their energy quotas.
- Refugees from Bangladesh and the Pacific make up 18 per cent of New Zealand's population. Others are being relocated to permanent settlements on the Antarctic Peninsula, which is projected to have a population of 3.5 million by 2040.
- In some countries it is a crime to publicly question the existence of man-made climate change.
- The oil price broke \$400/barrel in 2022, making shipping and aviation prohibitively expensive, and leading to a collapse in international trade.



protectionist world – *Globalisation has gone into retreat and countries focus on security and access to resources at any cost*

Globalisation has entered a phase of historic retreat in this divided world. Despite the Climate Agreement of 2012, accusations of 'cheating' in the carbon

markets and 'secret', undeclared power stations collapsed cooperation into factions. A poorly coordinated response to climate change combined with violent resource wars has fractured the world into protectionist blocs.

Climate change acts as a 'risk magnifier' – adding to the strains of communities unprepared for its impacts. The resulting competition and conflict drives up prices, discourages trade, hampers long-term planning and spreads disease that

maintains hunger and misery for millions. Mitigating further climate change is all but abandoned as the pressing needs of the current reality are prioritised.

Governments focus on securing supplies – hoarding assets, curbing exports and protecting their own economies through high import tariffs. Violent factions and cyber-terrorists capitalise on the chaos to promote and fund their nationalist causes – scrambling for resources, paralysing communication networks, and launching occasional but devastating bio-chemical attacks.

Communications like the 'world wide internet' have fragmented. A small group of academics preserve a global network, their dream to 're-unite' the world. Yet the experience for many today is one of financial hardship and empty markets; rising nationalism and social unrest; restrictive security; and sustained conflict over precious supplies.

- Conflicts over water have triggered devastating bio-chemical warfare in the Middle East and Africa. Soldiers fighting for nations and businesses are waging war over new sources of oil, gas and gold in the melting North-West passage.
- Morocco has been invited to join the EU in exchange for exclusive access to solar energy supplies for Member States through to 2050.
- Cyber-terrorists target businesses from safe havens in collapsed states and a series of massive data thefts has bankrupted two multinationals. Criminals levy 'taxes' in European cities in return for protection from attack by rival gangs.
- New diseases and pandemics, incubated by a warmer world, force the closure of borders.
- AsiaNet is firmly established as a faster, cheaper, more reliable alternative to the 'American Web'.



implications - 'the climate change years'

It's impossible to predict the future, but forward-looking organisations can plan for different futures. Indeed, we think this is essential if we are to navigate climate change successfully and promote sustainable development.

Our response to the scenarios is a set of five broad implications, derived from what some or all of the scenarios have in common, or based on insights throughout the process of building the scenarios.

prepare for a radically different future

We know that change is coming. As politics, society and attitudes transform in response to climate change, or as the climate system that we depend on transforms, business as usual is not an option. Businesses should:

- be open to the future – build long-term planning into the business
- not bet on one version of the future – long-term strategies should acknowledge uncertainty and build in adaptability
- prepare now – don't wait for the crisis to intensify.

seize opportunities for leadership

Addressing climate change offers companies opportunities for leadership which will them and society. Businesses can:

- look for leadership opportunities that give immediate returns, such as driving carbon efficiency through the supply chain
- acknowledge the long-term benefits of a leadership position, for example in terms of brand or government relations
- talk to investors about climate change, and emphasise the long-term commercial necessity of taking action.

embrace technological solutions

Technology is an important part of the response to climate change. Although some technologies – energy-saving, renewables and ICT – look successful in a

range of different futures, we can't be sure which will be most effective.

Businesses can:

- plan to exit from high-carbon technology by identifying what they are using and making plans to replace it
- explore opportunities for low-carbon technology, supporting and monitoring innovation in this area
- explore different drivers of technology development – benefits to society and the environment may present commercial opportunities in the future.

be part of the solution

The response to climate change we see in 2008 is trivial compared to what is required. But taking action now can open up new paths of hope and opportunity.

Businesses should:

- not be paralysed by the scale of the challenge. Devote boardroom time to overcoming barriers to action
- help create a positive future by lobbying for change, identifying new business opportunities, developing partnerships to find solutions and talking publicly about the importance of urgent action.

support global agreement

Policy on climate change developed now is more likely to use liberal market interventions – if we wait for climate change to get worse, tighter regulation is more likely. And if we wait to act on climate change, the global institutions we may need to help us could be undermined by the impacts of climate change. What's more, the longer we leave it to tackle climate change, the bigger the problem gets and the more likely it is that climate change policy will work against the grain of other policy. Businesses should:

- support changes to markets now, to avoid tight regulatory constraints later
- support the 'right kind' of globalisation, by maintaining fair global trade, fostering links between cultures and finding ways to share the proceeds of growth within and between countries
- take a systemic view of the operating context and design strategies for a climate-changing world, not just climate change.

factors shaping the future

How humanity responds to climate change between now and 2030 depends on a bewildering array of factors and the interactions between them. In order to understand this better, we interviewed some of the top scientists, business leaders, activists, and commentators from around the world about their hopes, fears and expectations for the future.¹

Processing the wide range of opinions that we heard during this exercise led us to categorise the factors that could shape the future response to climate change into seven broad areas:

1. The direct impacts of climate change
2. Public attitudes to climate change
3. How the business community responds
4. The nature of the global economy
5. The availability of natural resources
6. The political response, at a national and international level
7. Which technologies are developed and used.

Each of these is explored in detail below.

1. the direct impacts of climate change

The most important factor shaping our future response will be what happens to the climate itself. Although we cannot be sure about how the climate will change, the Intergovernmental Panel on Climate Change (IPCC) collects, assesses and summarises all the research evidence available in order to help reduce uncertainty. Its 'assessment reports' are the collective voice of hundreds of climate scientists from around the world.

estimating the impacts

The IPCC's fourth and most recent assessment was published in 2007, giving a mid-range estimate for the next twenty years of an average global warming of 0.4 °C (on top of the 0.7° we've already had).² It also states that over the coming years:

- the frequency and intensity of storms are likely to increase
- there will be more areas affected by drought
- there will be more and hotter heat waves in temperate zones
- ecosystems will be affected and biodiversity will be hit
- certain diseases could become more common
- sea levels are likely to rise. The IPCC estimates between 18 and 59 centimetres by the end of the century, although the level of shoreline retreat will be much greater due to landscape morphology.

These estimates may prove to be accurate. But it seems more and more likely they will be looked back on in years to come and seen as timid. Since the deadline for the last assessment report, climate science has come a long way.

Thomas Homer-Dixon, the Canadian scientist and author, told us in his interview that the most recent climate data has more serious implications than anything considered by the IPCC: "The IPCC guillotine came down in 2005. Since then, there has been increasing concern about positive feedback, coming quicker and stronger than expected and having unpredictable consequences for the planet. Climate scientists have been astonished by what has happened in the past few months." This positive feedback would accelerate climate change, meaning that processes thought only possible in the far future could happen much sooner.

John Christensen, head of UNEP's Risoe Centre on Energy, Climate and Sustainable Development, had similar concerns: "We're breaking meteorological records at a record speed. These changes are happening faster than the IPCC predictions and they will have an accelerating effect."

"In Bangladesh flooding is normal. It's tropical and a delta. But what we are observing at the moment is that before big flooding came every 10-15 years. Now there is one after another. 2004 and 2007 both had big floods. There are also more frequent floods now, due to rainfall in India and Nepal. It's affecting crops and people are taking shelter and are expecting external assistance. Over a period of three years about 10-11 million people have been affected."
Nazmul Chowdhury,
Practical Action Bangladesh.

¹ We list the people we spoke to in the appendix. ² The IPCC WGI 4th Assessment Report projects a scenario-independent global temperature increase of about 0.2°C per decade for the next two decades.



“In the tropical belt we see climate change and the effects of climate change right now – more frequent and severe hurricanes, more rainfall during the dry season and little rain during the wet season.”

Dr Evelia Rivera Arriaga, professor at the Centro de Ecología, Pesquerías y Oceanografía del Golfo de México, Universidad Autónoma de Campeche.

A report from Friends of the Earth in Australia, *‘Climate Code Red’*, reviewed some of these changes. It makes alarming reading – Arctic sea ice could disappear in summer by 2013, almost a century earlier than suggested by the IPCC; flows of glaciers in Greenland and West Antarctica could increase; and faster and more significant sea level rises, ocean acidification, decreases in the absorption of CO₂ by the oceans, and releases of greenhouse gases from soil and forests due to warming – are all anticipated.

reflecting uncertainty in the scenarios

In constructing our scenarios, we had to decide whether or not to reflect this uncertainty about the environmental impacts of climate change, and perhaps have one scenario where climate change proceeds at the pace described by the IPCC reports, one where climate change is slower, and one where it happens faster. In fact, for a long time, this was the intention of the research. However, it was decided not to do this for five main reasons:

- the climate in 2030 will be overwhelmingly determined by levels of past pollution. Action taken between now and the 2030s is very unlikely to have any impact until after that date. We did not want to suggest otherwise in our work.
- applying this variability risked suggesting that climate change was the only factor determining future responses. Instead, there are a bewildering number of drivers, from available technology to political will.
- through applying climate change as a constant across all of our scenarios we would be able to explore those other determining factors in detail.
- as the project progressed, the low-range estimates from the IPCC looked more and more implausible.

- finally, we decided that there was less strategic value in considering worlds in which climate change happened slowly or by some miracle not at all. As one futurist has written, “The essence of futures studies is to challenge the assumption that the future will resemble the present, and to explore ways in which it might be different.”³

“If current trends continue in the next 10-15 years we’ll have big problems.

If the glacier lakes burst it would create a lot of destruction. People who live in the mountains will have severe irrigation problems. The size and number of glacier lakes are increasing. Lakes are increasing in all of the Himalayas, Afghanistan, Northern India and Nepal, for example. Our soil is very loose. When the lake finds a way through it will have a big impact. It’s easy for them to burst.”

Gehendra Gurung, Practical Action Nepal.

So the five possible future worlds that we describe are different responses to a similar level of climate change. In all of them, climate change is a serious problem and follows a path towards the upper end of IPCC estimates, with pronounced effects on species, seasons, ice melt (glaciers, sea ice and permafrost), forest die-back, and accelerated glacial flow.

Our scenarios do, however, vary in two aspects regarding the impact of climate change. Firstly, there is the role of severe climate change-

related events. As in our Service Transformation scenario, the effect is to galvanise action. But we also explore in the other scenarios how serious action on climate change might be possible without the need for a catastrophe.

Secondly, in each of the scenarios, the future of climate change beyond 2030 is very different. This is a result of the type of response seen so far in that scenario. For example, in Efficiency First, advanced technology propels falls in greenhouse gas emissions and

“Agricultural productivity is expected to decrease significantly over the next 20 years in places like Africa. Who will feed these people? The melting of the Himalayas would affect about two billion people in China and India alone.”

David Runnalls, president of the International Institute for Sustainable Development.

³ G. Coyle – ‘The Nature and Value of Futures Studies’ in Futures 29 no.1, pp 77-93.

so for many people climate change feels 'solved'; though other serious environmental problems loom. In Protectionist World, the collapse of the global polity leads to an 'each for his own' response, with the emissions that result soaring out of control.

events

A surprising number of experts we interviewed thought a severe climate change-related event will be necessary to galvanise action. Thomas Homer Dixon told us, "We probably will see mobilisation, but this depends on what sort of shocks we see and when. For example, if there is a dust storm at the Beijing Olympics, or a collapse in Australian agriculture. If this happens soon enough, it could mobilise people. The critical question is, will it be soon enough?" There was a widespread belief among those consulted that current activity is not commensurate with the level of the challenge and that the science alone is not powerful enough to convince electorates, consumers, businesses and governments of the need to act.

This shows a chilling lack of confidence in our leaders. And if it's true it means we're playing a dangerous game. The worst ravages of climate change could already be upon us if we have to wait for a catastrophe in order to get going. Our only hope would be for an isolated, serious pre-taste of climate change to happen soon enough for the political and behavioural response to have a useful impact. This is probably wishful thinking, as Jonathon Porritt, founder director of Forum for the Future and chair of the UK's Sustainable Development Commission, pointed out in our interview with him:

"I have occasionally fantasised about a low mortality-count scenario where a Force Six hurricane takes out Miami, but with plenty of warning so the entire

"On the impact side, the uncertainty varies from 'a little bit worse than business-as-usual' (a few more droughts, floods, heat waves, that we could mostly cope with by muddling through) to 'nearly too late for action: major Manhattan-project style effort needed now'."
Mick Kelly, University of East Anglia.

city is evacuated with zero loss of life. The insurance industry in America would collapse because this could be a \$50-60 billion climate-related 'natural' disaster. The industry wouldn't be able to cope with that. There would be knock-on pain throughout the global economy, massive, traumatic dislocation. This would act as enough of an injection of physical reality, coupled with financial consequences for leaders to say: 'Ok, we've got it now. This isn't just about some nasty effects on poor countries: this is devastating for our entire model of progress.' The response to that would be a negotiated transition towards a very low-carbon global economy that builds increased prosperity for people in more equitable and sustainable ways."

2. attitudes to climate change

The public perception of climate change will underpin any political or economic response to it.

This begins, of course, with the science. In the past few years, the science of climate change has moved firmly into mainstream media across the world. It is likely to stay there as the capacity grows for computer models that anticipate and make projections in ever-finer detail. We can be fairly sure that the direct impacts of climate change – on livelihoods, communities and landscapes – will also be reported widely, though in our Environmental War Economy scenario, an attempt is made by European governments to conceal the full death toll from a severe heat wave in 2027.

"I have a feeling that by 2030 the environmental issues that are currently seen as technical problems of production and consumption that we can fix, will mount up to such an extent that people will understand them as a much more fundamental commentary on how we live. We'll travel less and be more focused on relationships. People will buy experiences, not products."
Ben Tuxworth, director of communications, Forum for the Future.

the future of the media

Media itself is likely to change enormously in the timeframe our research covers. By 2030, 'broadcast journalism' such as newspapers, television and radio may have been superseded by more distributed means of relaying information. Eyewitnesses, rather than journalists, supplied much of the footage of the Asian tsunami of Boxing Day 2004 and the London bombings of July 2005. We can expect less centralised control of the media in the decades to come, especially in the more technology-rich future explored by Efficiency First.

The effects of this are difficult to predict. The dominant trend could be one of fragmentation, a lack of trusted sources and no clear overall picture. On the positive side, it may mean that people are able to empathise more directly with others around the world. Bill Thompson, who has written widely on the use of ICT,

"Could there be a backlash against climate change if the climate doesn't obviously change in the next few years? People will become cynical if the predicted disasters don't occur."

Claire Fox, director of the Institute of Ideas.

"Something that has been largely missing from the debate so far is what the responses of the major religious faiths will be. Europe is largely secular, and we sometimes forget how important religion is in peoples' lives and politics in other parts of the world. The major faiths have been very slow to pick up on climate change... although we have started to see evangelical Christians in the US saying that climate change is an important moral issue. How the world's major faiths, in particular Islam, Christianity and Hinduism respond to this challenge will be crucial – and it's a big unknown at the moment."

Peter Madden, chief executive, Forum for the Future.

discussed this in our interview with him: "Citizen journalism will expand massively in the developing world. We will witness disasters through the eyes of the affected, not western journalists. It will be less easy to control the news agenda. The next environmental disaster will be reported by the victims themselves."

Empathy with the victims of climate change is likely to be powerful, as most

people will be experiencing the impacts directly themselves. As Peter Madden, chief executive of Forum for the Future, told us, "Attitudes will transform as we feel the effects of climate change." The sense of 'we're all in this together' is an important aspect of our Service Transformation scenario.

lifestyle choices: values and priorities

But will this be enough to prioritise climate change above the many other pressing issues of 2030? There is no guarantee that climate change will come top of the list even if the impacts are severe. Although we should hope that the clear links between prosperity and environmental health are made, economic development could still trump the environment if they come into conflict. Professor Young Ku from the National Taiwan University of Science and Technology, told us that "99 per cent of Asians would probably put development as the number one issue. They believe that their life is much worse than lives in the developed world, so the top priority is to improve their lifestyle."

For the world's burgeoning middle classes, a key question is whether there will be a willingness to modify expectations of a western-style consumerist lifestyle in the light of environmental pressures. The conclusion of many of the experts we interviewed was that this was unlikely. As Young Ku told us, "To see that wealth is not equal to happiness, you must already be a rich man'... I think the problem is 'how rich is rich?'" Frances Cairncross, a former president of the British Association for the Advancement of Science, talked about the irresistible attraction of the automobile: "The lust for travel and to own your own car will extend into the developing world. The car is a symbol of achievement... a public sign of affluence." Dr Quentin Chiotti agreed that "the trend in places like China and India will be no different. They will continue to pursue the 'western dream' as a basic entitlement. Society will remain narcissistic."

"How tolerant will rich people in rich countries be of injustice, and to what extent will they demand action? They might also be feeling very insecure, economically pinched themselves; will the dominant reaction be to entrench and deal with the home front first, or to reach out to the global community?"
Antonio Hill, senior climate change policy advisor at Oxfam.

“What I don’t get is why aren’t people out in the streets?”

Thomas Homer-Dixon, professor of international affairs, University of Waterloo, Canada.

But how aspirations change when they meet serious environmental limits is uncertain. Amory Lovins believes that “there is no need to change lifestyles to tackle climate change. There are other good reasons for lifestyle changes – better quality of life – but this shouldn’t

be mixed up with what needs to be done to tackle climate change.” If this turns out to be the case, it could obviate the need for many tough political as well as personal decisions, as protecting the climate could turn out to make money rather than cost money (for example because saving fuel costs less than buying fuel), and so prove uncontroversial.

Some of the experts we spoke to thought that a values shift was inevitable. Quentin Chiotti said that “values and priorities will have to change. There will be a shift between ‘wants’ and ‘needs’.” Some saw this shift taking place already: “A learning for me is that most communities, organisations and individuals are reacting positively to the challenge,” said Nazmul Chowdhury, “at a grassroots level, when there is no external assistance, people help each other.” Ryoichi Yamamoto, Professor at the Institute of Industrial Science at the University of Tokyo, explained that “in Japan 150 years ago, we were living in a recycling society. Then came western civilisation which we adopted, and we forgot traditional culture. Many Japanese people feel it is necessary to rejuvenate this environmentally friendly culture... One characteristic of Asian culture is symbiosis with nature, as opposed to the western culture which tries to conquer nature. I believe it is necessary to have both cultures come together to bring an environmental civilisation.” We explore how a widespread shift in values of this type could take place in our Redefining Progress scenario.

“The world economy will be more risky because of ‘freak’ weather. Events similar to Hurricane Katrina will become more frequent, leading to economic catastrophes. So business will be more risky, especially in equatorial regions. Much of China is in typhoon territory and many skyscrapers will not be able to handle super-typhoons.”

Professor Richard Welford, University of Hong Kong and chairman of CSR Asia.

It is to be hoped that such positive engagement with climate change will prevail. But as the impacts of climate change become severe, there is a risk of frustration, anger and despondency – especially if action seems in vain or isn’t supported by others’ actions. Some could envisage a situation in which, in the words of the president of the International Institute for Sustainable Development, David Runnalls, “Climate-phobia takes hold... It’s like people setting up deck chairs on the Titanic... people are throwing up their hands – the task is just too daunting.” This attitude plays a part in our Protectionist World scenario.

“We are going to think of entirely new social arrangements, technologies, institutions and organisations, and economic frameworks to solve the problems of healthcare, education, global warming, sustainability, water, etc. We are on the on-ramp and we are so in it that we can’t see it. This is going to make the 1960s look like piano finger exercises. This is the big symphony.”
Arnold Wasserman, chairman, The Idea Factory.

3. the business response

Global business will need to respond to the challenge of climate change, and how this happens will be critical to shaping the overall human response. Daniel Gagnier, chairman for the International Institute for Sustainable Development, put it to us well: “All sectors will be impacted for different reasons. No-one will be off the hook.”

a risk or an opportunity?

In part the business response is about anticipating and managing risk. Many business sectors will be affected severely by changes in the weather – insurance, agriculture, fisheries, forestry, real estate and tourism are highlighted in one analysis.⁴ Many energy-intensive industries will also be affected by the rising costs of polluting the atmosphere, if legislation leads that way, and this will affect another broad swathe of sectors.



⁴ Jonathan Lash and Fred Wellington – ‘Competitive Advantage on a Warming Planet’.

“Business can and will deliver solutions – if governments ask it in the right way.”

Tom Burke, visiting professor at Imperial and University Colleges, London.

But it is not just about risk. For business to prosper in the future, companies need to be able to spot and exploit commercial opportunities even in difficult circumstances. This is already beginning to happen, as Arnold

Wasserman, chairman of The Idea Factory, observes: “Addressing the big problems has now moved from corporate social responsibility into ‘hmm, how can we make money from this, how can we make new business ventures, whole new industries, out of sustainable economic development?’ And many companies are now working on this and that shift is huge.”

This shift affects operations, products and supply chains. Wal-Mart in the US became the world’s largest buyer of photovoltaic cells overnight, after committing to only use energy from renewable sources. HP’s goal is to reduce the combined energy consumption and associated greenhouse gas emissions of HP operations and products by 25 per cent below 2005 levels in 2010. Toyota has become famous for its hybrid car and the Volkswagen Bluemotion Polo emits even less carbon dioxide per kilometre.

Supply chain initiatives could have far-reaching impacts on thousands of companies stretching around the world. Such initiatives could be as significant as political treaties, a point made to us by Robert Falkner, a senior lecturer in international relations at the London School of Economics: “The business supply chain is where countries like China are more susceptible to external pressure. Legal requirements can be challenged at the WTO, voluntary measures – for example Tesco’s supply chain policies – can’t, so managing supply chains for carbon reductions could be a powerful force.”

“Impacts will be variable – take aluminum smelting. The obvious answer is that the full cost of carbon in smelting will provide an incentive for people to develop substitutes. But there will be winners and losers within the sector. Some big aluminum smelters are powered by hydro-electric power. They will do well because they will have lower costs compared to competitors subject to the increasing carbon price.”

Climate Futures interviewee.

business as usual?

The current business response is a long way from where it will need to be in 2030. Quentin Chiotti of Pollution Probe Canada remarked to us: “Early adopters will do well, but they are now in the minority, which does not bode well for the mainstream adoption of climate-friendly practices. There are too many heads in the sand right now.”

If things continue with this approach, we could see large numbers of companies rapidly going out of business through a failure to adapt to new circumstances. Such an unhappy prospect would very likely lead to a downward economic spiral and serious knock-on effects for consumers. Hardly more palatable is a world that has woken up to climate change too late, in which governments focus on protecting their own assets and business struggles to adapt as globalisation retreats. Our Protectionist World scenario explores this eventuality.

three possible pathways

Assuming that the business community does shift in its response to climate change in the years to come, our research indicated that there are three main ways in which this might happen.

First, businesses could invest heavily in new technology that enables them to do what they are currently doing, only on a scale of efficiency never seen before. This approach is partly envisaged by Amory Lovins of the Rocky Mountain Institute: “I think the real drivers here will not be public policy, which will always be trying to catch up with the more dynamic private sector and civil society, rather it will be a combination of innovation in competitive strategy, in technology and design

“There are very few protagonists who present a low-carbon world as though it were a world of opportunity and enlightenment, of improvement and social justice. There are very few organisations or individuals who are turning the reality of low-carbon into the next stage of the evolutionary trajectory of human-kind, as in more progressive, smarter, fairer, more compassionate, better balanced in terms of what it is human beings need. There is a collective, systemic failure when it comes to seeking out a more positive future in a low-carbon world.”

Jonathon Porritt, founder director, Forum for the Future.

integration that really makes most of the running.” The rules of business need not change, though market signals would have to be clear. As Paul Dickinson, CEO of the Carbon Disclosure Project, said, “Business has no ideology. If saving the world makes more money, than that is what everyone will do.” This approach forms an element of our Efficiency First scenario.

A second type of response, encouraged by a much higher carbon price and predicated on a change in consumer values, is characterised in our Service Transformation scenario. Here, companies are led to reconsider the fundamentals of how they make money, innovating new business models that deliver social and economic value within environmental limits. In this response, as discussed by Glenn Lyons of the University of the West of England, car companies would look to profit from selling mobility services rather than more cars: “In 20 years, the car industry could re-invent what it means to own a car... In a ‘soft’ way the industry could thereby maintain its commercial viability.” One of our interviewees also talked of such a future: “Currently all businesses are based on supplying more stuff, as with the pharmaceutical industry, where the current incentives and business models are about selling pills, not preventing harm or promoting health. I hope that we will develop business models where we pay for providing less stuff – this is the key.”

Finally, we could see a world in which materialistic consumer values have been superseded and business plays a very different role in society to what it does today. The trajectory to such a world may appear from today’s perspective longer and less likely than to other possible worlds in 2030, but it is one we explore in Redefining Progress.

4. the global economy

Global trade has grown over the past decade at twice the rate of economic output. But the degree of linkage and connectivity in the global economy of the future is far from certain. The impacts of climate change, as well as how humans respond to it, have the potential to create profound changes to the structure and performance of the global economy.

The experts we spoke to identified four key issues – the degree of international cooperation, the performance and structure of the global economy, the development path chosen by emerging economies, and the possible emergence of new models of ‘post-consumption’.

the degree of international cooperation

For some, globalisation offers the only solution to climate change – scaling-up solutions, sharing technologies, increasing flows of capital, expanding global communications, and using the power of the market to tackle what is fundamentally a global problem. Daniel Gagnier argued that population displacement, resource disputes and global equity issues all point towards increasing global cooperation as the only solution. As Sir Crispin Tickell, a former UK ambassador to the UN told us: “It is not just global benevolence, it is national interest, and national interest requires a global regime.”

For others, a partial breakdown in global cooperation is a very real possibility. The challenge of dealing with climate change and its knock-on impacts on resources, such as water supplies, was considered potent enough to reverse the globalisation trend. The British member of parliament and chairman of the influential All-Party Parliamentary Climate Change Group, Colin Challen, told us: “If we get into a period of chaos and more self-interest becoming evident, then my view is that the world economy will start disaggregating and breaking down into its original component pieces.” Even those experts that we spoke to who placed the greatest faith in the advancement of globalisation were prepared to consider this possibility – whether caused by climate change, conflict, economic protectionism, energy constraints, global epidemics, or an increase in conflict and terrorism.

For Colin Challen, it might be the failure to reach a climate agreement combined with a realisation of the severity of the impacts that could precipitate a breakdown: “If we can’t get to that agreement within the next two or three years, I think we are really going to tip into a more international anarchy where there will be sort of unilateral demands made on some countries by others... If you tie that with the sort of increasing potential for nationalism and the sort of ‘we’ll look after our own first’ attitude, I think that is a very dismal prospect... We have to prepare for that.”



Several experts linked this type of outcome with more nationalistic political and economic models, which might prioritise the keeping of financial capital and natural resources within national borders. Suspicion of other countries; anti-immigration and xenophobia would rise; trade barriers and tariffs increase; and a resentment between rich and poor nations further collapse cooperation.

The role of the military in responding to climate change would be central to such a scenario. As Tom Burke told us: “There are no ‘hard power’ solutions to climate change – you cannot go to war to stop emissions. But there are hard power consequences of failing to address climate change.” Energy and water supplies were repeatedly cited as likely flashpoints.

A world where nations and citizens turn inwards, becoming more nationalistic and divided, is the plausible possibility considered in Protectionist World.

the performance and structure of the global economy

The EU recently cautioned that: “reductions of arable land, widespread shortages of water, diminishing food and fish stocks, increased flooding and prolonged droughts” could lead to increasingly hostile competition between states around the world for dwindling resources.⁵

Several studies have recently sought to highlight how climate change can exacerbate multiple threats – what is termed a ‘threat multiplier’ – and so further perpetuate instability. Tom Burke explained: “People simply do not get the scale of what climate change means. It is a systemic problem – it is one that touches all the others. It will stress all the other stresses in the world. We cannot look at it in a silo... All the pillars of prosperity are being undermined.”

Those areas of the world that are today the most environmentally fragile, resource-poor, conflict-prone and with weak governance are the most vulnerable. Climate change could compound violent conflict and resource constraints, leaving communities poorer and less resilient to its further impacts, thus precipitating yet more political instability and economic decline. One estimate has suggested that 2.7 billion people worldwide could be at high risk of violent conflict from such exacerbating changes in the climate.⁶

The threat to economic prosperity worldwide is a serious consideration and the potential for large-scale shifts brought about by climate change is real. As Polly Courtice, director of the University of Cambridge Programme for Industry, explained: “We are at the start of a major realignment of the global economy, one in which companies that adopt low-carbon strategies will be best-placed to survive. Certainly those with carbon intensive businesses will be in trouble. Alongside this we are likely to see the rapid emergence of small entrepreneurial businesses seizing the many new opportunities that this volatility will provide.” The availability of financial capital – the balance of recession and growth in the years to 2030 – will clearly guide the amount of investment available for economic growth, technology and the means to combat climate change.

the development path of emerging economies

Many have predicted a significant shift over the next 20 years from western to Asian centres of economic power. The development paths followed by Brazil, Russia, China and India are clearly the most significant due to population size, carbon emissions and growing geopolitical power.

There is the potential for such countries to ‘leapfrog’ traditional development paths and rapidly shift to a low-carbon economy, drawing on the experience and technology of the West to roll-out and scale-up solutions on a level never seen before. As Jonathon Porritt told us: “China may become the biggest single agent of increased devastation through climate change, almost at the same time as it becomes the sustainability exemplar to the rest of the world. With Chinese citizens dragooned into more sustainable patterns of living, whether they like it or not, there is a very real possibility that China becomes the leading agent of low-carbon transformation.”

Similarly, some of the most interesting examples of sustainable cities are currently emerging in the Middle East, such as the planned zero-carbon, zero-waste Masdar City in Abu Dhabi.

new models of post-consumption?

With a shift from West to East, booming economies and connected populations, there is the distinct possibility that non-western development paths could gain

⁵ ‘Climate Change and International Security,’ March 2008. ⁶ ‘A Climate of Conflict: The links between climate change, peace and war,’ International Alert, November 2007.

greater credence. At one extreme, the development strategies adopted today by Cuba, Bhutan, Nicaragua or Thailand could be the pioneers of future diversity. Here, new priorities, particularly around 'quality of life', have sidelined many aspects of traditional western development models.

Climate change has a clear potential to shine a light on different development approaches and priorities. There is relatively widespread acceptance that indicators of gross domestic product are misleading and fail to capture the full richness of human and environmental development. In March 2008, 40 years after president John F. Kennedy first challenged the indicator, a US Senate Committee held a hearing entitled 'Rethinking the gross domestic product as a measurement of national success', while France's president Nicolas Sarkozy recently announced that, "we must change the way we measure economic growth," and set-up a taskforce to examine a new definition.

Sara Parkin, founder director and trustee of Forum for the Future, offered the view that, "the economy at the moment is more about the career of cash than it is about people and the environment." The suggestion is that a new focus on 'wellbeing' could help reverse trends of excessive consumption and waste, leading to a better direction for development. Antonio Hill suggested that a "willingness to address the question of absolute levels of consumption" could emerge not from the liberal thinkers of the West, but from the emerging economies in the developing world.

Our Redefining Progress scenario explores how changes to the desirability of consumption might come about and lead to a dramatic reshaping of outlooks and economies.

5. resources

Resources such as energy, water, food and land form the backbone of the responses to climate change. They will of course vary across time and place by allocation, availability, flow and use. But it is the interaction between these natural stocks and human capital that will produce the most interesting outcomes.

energy supplies and security

Foremost in the minds of many for the next two decades will be energy, specifically the availability of supply and its links to security. Forecasts suggest that global demands for energy, particularly from India and China, will grow rapidly. The International Energy Agency estimates that based on current trends, energy needs might be well over 50 per cent higher in 2030 than today.⁷

The energy sources that the world will consume in 2030 are difficult to predict due to the mind-boggling array of variables – supply, demand, technology, regulation and economics, will all interact. Most forecasts predict a heavy reliance on fossil fuels – oil, gas and coal – at least until 2030. Nevertheless, the precise mix is unknown. Shell has stated that, "after 2015, easily accessible supplies of oil and gas probably will no longer keep up with demand,"⁸ while the chief executive of the world's largest energy company, Gazprom, suggested that oil will cost \$250 per barrel "in the foreseeable future".

The outcomes of such changes are hotly contested and could result in investment in power from coal, nuclear, renewable, or unconventional fossil fuel sources such as oil sands. Our scenarios carefully explore these possible energy mixes; from the technological solutions in Efficiency First, to the explosion of localised renewables in Redefining Progress.

Whatever the role of fossil fuels, the political control of supplies will be crucial. The potential for a scramble for resources, driven by booming populations and rocketing prices, could easily lead to conflict. Nearly three quarters of the projected increase in demand for energy is expected to come from developing countries.⁹ Several interviewees highlighted how some countries could prioritise aggressive resource exploitation at the expense of environmental agreements, undermining efforts for a low-carbon economy. Dr Robert Falkner, an expert in international relations, suggested that international negotiation and support will be key: "China will need to receive financial support from others to develop clean coal approaches. Their priority is cheap energy quickly; sustainable development is a marginal concern compared to this."



⁷ World Energy Outlook 2007, International Energy Agency. ⁸ Jeroen van der Veer, chief executive of Royal Dutch Shell plc, 'Two Energy Futures', speech on 25 January 2008. ⁹ World Energy Outlook 2007, International Energy Agency.

Alternatively, high prices of resources like oil could be a key propellant to greater energy efficiency, and also the rapid development of renewable sources of power. The energy outcomes from the particular price pressures of an economic depression are explored in Redefining Progress.

other natural resources

The availability and access to water, land and food will play a growing role on the world stage as demand grows from booming populations and the impacts of climate change are increasingly felt.

For agriculture, climate change could take large areas out of production. Flooding, drought, collapsing fisheries, expanding deserts, declining soil fertility, shrinking forests and increasing extreme weather events pose particularly potent threats. For Africa, forecasts suggest agricultural production could be severely compromised with yields reduced by up to 50 per cent as early as 2020.¹⁰

Conversely, in other parts of the world, climate change will open up new areas to resource exploitation. Recent research has suggested that the Arctic could be free of ice in the summer as early as 2013¹¹, and there is already evidence of a rush for diamonds and gold amid ice melts in Greenland, as well as renewed interest in the untapped oil of the Arctic.¹²

Forests could re-emerge as a key asset class well before 2030 – their monetary value soaring from intense demand and the critical role they will play as carbon

“I’m quite excited about what happens when you recognise the different discourses. Some people focus on technology and markets as the solution, some focus on the limits of the biosphere. Some promote imaginative reform of design, technology and social systems. Others speak of a more spiritual sense of connectedness, which gives the energy for action. I believe that all of these have something to offer. But so often, there is disengagement across these different discourses. Finding ways to have a dialogue between them is very important.”

Peter Reason, director, Centre for Action Research, University of Bath, UK.

sinks and biodiversity reserves. Pressure to preserve and replant forests is likely to emerge as a particular priority.

For each of these critical resources over the next 20 years, whenever demand outstrips supply, the potential for conflict is huge. Uncontrollable demands, diminishing supplies, disputed sovereignty and violent conflict play out in Protectionist World.

However, perhaps the most unpredictable development will be how assets that become less available but are still subject to intense demand are instead replaced. As one interviewee in our research explained: “Part of the adaptive responses will be how we use other resources in another way.” Harnessing technology to redefine existing and new resources is explored in Efficiency First.

human capital

The pressure on the world’s natural resources from growing populations is likely to dramatically increase. Forecasts from the UN suggest that by 2030, there might be 8.2 billion people on earth, almost five billion of whom will live in cities.¹³ The pressures on resources created by one billion urbanites in China by 2030 could be immense and highly unpredictable,¹⁴ while countries in Europe and North America are likely to face new challenges from ageing populations.

One of the most important interactions will be how climate change shapes patterns of migration over the next two decades. Refugees and displaced people could become a huge international issue, reshaping cities, social structures and economies. Climate events forcing such migrations might be slow, incremental stresses, or sudden impacts forcing massive transnational movements. The security implications of such movements will be profound.

But population impacts from climate change are not a distant, future trend. From flooding in Bangladesh to drought in East Africa, climate change is already severely affecting the lives of millions. The UN estimate that there are currently 25 million displaced people within national borders, caused by a variety of natural disasters¹⁵ – a number that will only rise and increasingly cross international boundaries. These changes will create what the European Commission’s Peter

¹⁰ ‘Climate Change 2007: Impacts, Adaptation and Vulnerability.’ Working Group II Contribution to the IPCC’s Fourth Assessment Report. Figures 9.2, 9.4, 9.6. ¹¹ Professor Wieslaw Maslowski – BBC News, 12 December 2007.

¹² The Guardian, 4 October 2007; US Geological Survey, July 2008. ¹³ ‘State of the World Population 2007’ – UN; ‘Population, Resources, Environment and Development dataset’, 2005 Revision.

¹⁴ ‘Preparing for China’s Urban Billion’, McKinsey Institute, March 2008. ¹⁵ ‘2007 Global Trends: Refugees, Asylum-seekers, Returnees, Internally Displaced and Stateless Persons’ – UN, June 2008.

Johnston called a “higher premium on safe places”. Coastal communities may experience forced migration of populations. Thirteen of the world’s 20 current megacities are situated at sea level, and rises could result in salination of costal freshwater aquifers and disrupt storm water drainage and sewage disposal.¹⁶ The emergence of a strong state structure to direct such movements is explored in Environmental War Economy.

6. the political response

The response of political leaders around the world to climate change is a complex factor with many dimensions. Political priorities vary by time and place, but perhaps most important will be whether climate change appears to reinforce or compete with other priorities. While most attention has rightly focused on the international stage, leaders can also act nationally through government channels and in the patchwork of politics in regions, cities and localities.

The precise approach adopted – from market incentives to state-led behavioural change – will also vary, as will its effectiveness. Our scenarios incorporate a wide range of political priorities and demonstrate how the choices made by current political leaders over the coming years will be critical to the shape of the world in 2030.

a global agreement?

The prospects of a global agreement to tackle climate change by 2012 – when Kyoto’s emission targets expire – provoked widely differing views from the experts we spoke to. In order to be effective, any agreement must gain support from the US and China. Clearly, the political realities of ‘who moves first’ of the world’s superpowers will play a strong role in both the likelihood and detail of any international agreement.

There was widespread disagreement over how binding and effective any agreement might be, what price carbon would be set at, and whether certain countries might subsequently suffer or prosper. In particular, the role of the US was hotly contested. Thomas Homer-Dixon told us: “In the US it’s fairly clear what will happen. Climate change aligns nicely with the energy security issue.

Once the US decides to act on climate change, it will act quickly and effectively – using market mechanisms.” Arno Harris, co-founder of Recurrent Energy in San Francisco, predicted that the rewards of such a system for the US could “make it the policy centre for the world, or at least the largest carbon market”. Recent estimates suggest that such a US market could be worth \$1 trillion per year by 2020.¹⁷

Others saw a less rosy outlook. Dr Robert Falkner suggested that “economic dislocation in the US between 2012 and 2020” was possible due to a heavy reliance on oil: “The US is locked-in to carbon, and there will be pain.” These differences – between a profitable transition to a high-tech, low-carbon economy, or a sometimes painful adjustment to new lifestyles with costly carbon – are explored in the contrasts between Efficiency First and Service Transformation.

“From the early 60s on, the provision challenge in the West was met. We entered the age of leisure... But we are re-entering an age of consequences where the life of the world is cast upon the dice. It’s time for us all to look at ourselves and how to rise to this occasion, because we are going to be judged by each other.”
Paul Dickinson, CEO,
Carbon Disclosure Project.

For others, the possibility of any international consensus appears unlikely. David Adam, environment correspondent from The Guardian, explained: “It takes a huge leap of faith to believe that political attitudes will change. It’s not a natural instinct to act outside of your own self-interest... Politicians talk about helping people of the future, but we don’t have a good track record of actually doing that on anything.”

Colin Challen also painted a worrying picture: “We are at a tipping point between an internationalist response and a nationalist, protectionist response. The latter is the more likely to occur, and is worse for all of us.”

a business effort or a war effort?

A lack of global cooperation does not preclude intensive efforts at a regional and local level. Dr Steve McGuire, a specialist in international relations, told us that he detects an emerging Asian regional identity that could precipitate environmental

¹⁶ Jonathan A Patz, R Sari Kovats – ‘Hotspots in climate change and human health,’ BMJ volume 325 November 9, 2002, Clinical Review. ¹⁷ <http://environment.newscientist.com/article/dn13325-greening-us-likely-to-create-huge-carbon-market.html>



collaboration, while Peter Johnston suggested that a US state-level scheme could interface with an Asian scheme. Different regions could adopt completely different approaches: one a cap-and-trade, another taxation-based. Hence the idea of ‘regional leadership’ instead of ‘global co-operation’ was a variable we integrated throughout the scenario-building process from 2012 to 2030.

Similarly, state power could shrink substantially, and the locus of power shift elsewhere in societies. In Efficiency First, governments act out a supporting role, offering incentives and rewarding innovation, while the drivers of change are in business.

Conversely, the idea that a more aggressive, state-led response is necessary – or even inevitable – to tackle the challenges, emerged during the course of several interviews. Many used the language of a ‘war effort’. Tom Burke, who is experienced in advising politicians on climate change, predicted that government dithering would force a subsequent large-scale state reaction: “Government responses will be: prevaricate, prevaricate, prevaricate, then panic. The response after panic will not necessarily be sensible or make much difference... Meaning that climate change is about our very existence. It is a question on the scale of the Cold War.” The pathways to how such a state might emerge, as well as the likely resistance, are explored in our Environmental War Economy scenario.

national governments and political priorities

Whatever the prospects for a global agreement, it is the underlying national priorities that will promote or hinder cooperation. Jonathon Porritt said in his interview: “The idea that there is an alternative to dealing with climate change other than through globally mediated negotiations is pretty absurd.” But for others, action to tackle climate change at a national level does not hinge on global cooperation. Amory Lovins explained: “I don’t understand why environmentalists commonly assume that we can’t do anything without more treaties. China did not put energy efficiency as its top strategic priority for national development in the eleventh Five Year Plan because a treaty told them to do it. They did it because they know they cannot develop otherwise. There is so much self-interest to be engaged here.”

The political priority assigned to climate change – how far governments accept,

promote or resist responses – is clearly critical to both the national and global response. For democracies, the views of the electorate are significant. Research on the experience in Europe and Japan indicates that “when voters feel strongly enough, politicians can and do rise to the challenge.”¹⁸

But political priorities shift over time. In fact, the most important way of thinking about political priorities could be to ask: how much is climate change perceived to fit in with other policy goals? Do the challenges appear to contribute to or conflict with economic development, energy security, state conflicts or global terrorism?

“At the core, you cannot do climate security at the risk of energy security. That means you have to find a role for coal. That means that carbon capture and storage must work.”
Tom Burke.

The relationship between environmental measures and economic growth is perhaps most interesting. One interviewee in our research suggested that “the pecking order of priorities will be: economic growth; employment; energy security; climate change.” Professor Young Ku told us: “The relative importance of development versus tackling climate change is still a source of serious debate.” For others, the idea of picking either economic development or environmental sustainability is a false choice; the

interrelationship between the two is increasingly self-evident – climate change impacts will only intensify, hence awareness levels will redefine and reshape all other priorities.

Each of our scenarios explore how climate change fits in or competes with other policy agendas, with results for the approaches adopted – from the holistic sustainability of Redefining Progress to the clashing priorities, breakdown of trust, and failure to implement agreements in Protectionist World.

diverse approaches

The degree to which governments seek to directly influence the behaviour of citizens and businesses, or leave things to markets, will provide important differences from country to country. Professor Young Ku suggested that “the social acceptability of markets is less in Asia. Carbon markets will play less of a role. The approach in many countries will be through government setting policy,

¹⁸ Harrison and Sundstrom, ‘The Comparative Politics of Climate Change, Global Environmental Politics,’ MIT, November 2007, Vol. 7, No. 4: pp1–18.

and state-owned companies implementing these policies.” Richard Welford, professor at the University of Hong Kong, suggested that in China “There is more of an attitude that acting collectively can be for the greater good, rather than viewing it as a constraint on liberty.” The Chinese government’s current adoption of ambitious domestic plans to reduce energy use and promote renewable energy is perhaps early evidence of this.¹⁹

The difference in opinion of our experts highlighted how policy might vary between countries or scenarios. Polly Courtice, director of the University of Cambridge Programme for Industry, suggested we might see a “raft of new regulations” after 2012 that would represent “a very difficult political shift... We will live in a much more regulated environment. There will be a shift from market incentives to heavier, tougher regulation.” Conversely, Peter Johnston from the European Commission told us “the process of moving to a low-carbon economy will fail if government tells people what they can’t do. If it is a policy of constraint then it will fail. Too many people will rail against it.” He concluded that “our best chance is to accelerate innovation in new technologies and mobility services that are more attractive and lower-carbon.” Arno Harris, who founded Recurrent Energy in San Francisco, highlighted how California’s high-tech, low-carbon revolution is “an example of how you can accomplish amazing things by incentives.” The diversity of possible approaches was carefully incorporated into our worlds: the market-based, incentive-driven Efficiency First; the transformative, costly carbon of Service Transformation; and the state-directed world of Environmental War Economy.

adaptation – planning for the inevitable

Finally, planning for the actual impacts of climate change will undoubtedly form a central plank of future government policy. For some, favouring this approach is a moral hazard, implying we could adapt without focusing on mitigation. For others, such as Dr. Quentin Chiotti, “the dichotomy between mitigation and adaptation is grossly misunderstood. There is a persistent notion that focusing on adaptation means you are abdicating responsibility. Adaptation will become much more of a focus for governments. The next 10 to 15 years represent a key tipping point on this issue.”

Many felt that adaptation was currently being dangerously overlooked. Professor Ku suggested that in Asia “the cost of adaptation will be immense. Countries are not preparing for this... Taiwan is one of the most developed countries in Asia, but is only just beginning to think about the adaptation necessary.” Gehendra Gurung echoed this concern: “In Nepal we haven’t done much on adaptation. We’re struggling to make people aware at all levels... We need to build capacity to live with a changing climate.”

Some could envisage a time when a focus on adaptation superseded all other concerns. Bill Thompson suggested that “if we have to choose between massive investment in adaptation and the same in mitigation, which would we choose? Almost certainly adaptation, as that is more immediate... In future, as people start to understand, more will say, let’s adapt and cope... This is quite likely if a decent resolution post Kyoto is not reached.” Colin Challen could foresee a similar situation and highlighted how adaptation can be attractive as it is ‘owned’ rather than ‘shared’: “When push comes to shove... a number of people may well by then say ‘it’s already too late to mitigate so just spend it on adaptation and it will be *our* adaptation not Mozambique’s adaptation or Bangladesh’s adaptation’.”

7. technology

Technology has the potential to deliver revolutionary changes. Mark Bunger, research director at emerging technologies firm Lux Research, told us: “The bright future that I take for granted is informed by new technologies. Ten or 20 years from now, what we consider science fiction will be reality.”

It is tempting to think that two decades of research dedicated to solving climate change could make a technological solution almost inevitable. However, this prospect is far from assured and for many it is important to emphasise that technological developments are only a small part of the answer. As Quentin Chiotti said: “Technology will be absolutely critical but not sufficient by itself to create a sustainable world. Behavioural and structural shifts will be equally important.”

¹⁹ ‘The 11th 5-year plan for National Economic & Social Development of the People’s Republic of China’ (http://en.ndrc.gov.cn/hot/t20060529_71334.htm) – National Development and Reform Commission.





Tony Norton, from the University of Exeter's Centre for Energy and the Environment, warned that too much reliance on the power of technology could even be dangerous:

“What concerns me is the argument that there is a technological innovation in the future that will sort climate change out, so we can just sit and wait for the solution. Wrong answer. Technology will play a role, but it is a matter of behaviour. We need everything. I don't think we can rely on a technofix in the future.”

“Decentralised and carbon friendly energy technologies should get a chance in places where they are already preferred – places with ample sun, wind or water and not already connected, like India.”
Chris Hope, Judge Business School, University of Cambridge.

Jonathon Porritt and Sara Parkin were both keen to point out that most of the technologies we need already exist. David Adam agreed, saying “there is no miracle technology.” The risk is that unwarranted faith in a future ‘technofix’ is merely a convenient means of putting off difficult decisions on political and behavioural

change. Therefore, we should approach an analysis of the technological solutions of 2030 by exploring not just what will be available, but also what will be desirable, affordable, successfully applied or otherwise in each of our scenarios.

It is difficult to forecast the sort of technologies that will be available by 2030. We can look at where money is currently being spent on research and development – in nanotech, biotech, and so forth – but that can only give a hint. Frances Cairncross, a former president of the British Association for the Advancement of Science, told us how technology is always unpredictable and can be the driver of change itself:

“Technology development is not driven by legislation or even consumer pressure. It is a wayward, unpredictable thing. Take the telephone: it took 70 years before it became a technology used to sell insurance. At first, it was imagined as a broadcast medium: one-to-many. Only later was it used as a one-to-one medium. Something like clean coal ‘ought’ to exist. From

the struggle of trying to invent it, something quite different might emerge, a technology with quite a different purpose.”

One technological aspect that is perhaps more assured is that of computer power. It is likely that information technology will become much more powerful and pervasive over the next two decades. Frances Cairncross highlighted how “we’re just at the beginning of what some people call the ‘internet of things’, where individual objects talk to each other. It will take at least 20 years for the possibilities of that to become clear.” Because of the particularly fast-moving nature of ICT, new forms of computing technology exist in each of our scenarios. However, the popularity and purpose of different research streams weave many divergent paths.

geo-engineering

Geo-engineering – the large scale manipulation of the environment to tackle climate change – falls broadly into two categories: attempts to take carbon dioxide out of the atmosphere on a large scale (for example by seeding the ocean with chemicals that use carbon dioxide in a chemical reaction), and attempts to reduce planetary heating (for example by deploying giant mirrors in space to reduce the amount of heat from the sun reaching the lower atmosphere).

These approaches are not under serious policy consideration at the moment. Nonetheless, there is debate about their appropriateness. Some believe that because we already have a destabilising effect on the climate, we had better become experts at controlling it on a large scale, and that some form of geo-engineering is inevitable. Others believe that the complexities of large-scale climate control and the risk of unintended side-effects, mean that geo-engineering could not only backfire but also divert attention from more mundane practical approaches.

But could geo-engineering become a serious policy option one day in the future?

Sequestration might be on the cards if the concentration of carbon dioxide in the atmosphere has overshot an accepted critical point, ushering in a period of 'negative emissions' for some years. More controversially, it could be considered to allow expensive-to-reduce pollution to continue. It also might be considered, if an international climate agreement broke down, by a group of countries serious about tackling climate change and willing to go it alone.

Techniques to reduce planetary heating, on the other hand, would be considered under different circumstances. These approaches do not tackle the underlying cause of the problem (namely rising carbon dioxide concentrations) but instead tackle one of the symptoms – planetary heating. They do not tackle other significant symptoms – most notably, the acidification of the oceans – so cannot be used as a substitute for emissions reductions in any rational policy framework. Instead, they might be considered to buy time in the face of positive feedback cycles: where increased heat in the atmosphere results in increased emissions from natural sources, such as methane from melting permafrost. As emissions reductions take time to translate into reductions in heating, artificially holding the temperature down for a few decades to reduce positive feedback might be considered alongside a programme of substantial reductions.

So which are the current technologies – in use or development – that could provide a hint of the possible pathways towards 2030?

powering the future

Firstly, with energy demands set to increase, what might be the dominant technologies for energy generation in 2030? Some of the experts we spoke to suggested that coal must play a key role in fuelling the booming economies of China and India. The availability of domestic supplies, as opposed to distant or dwindling gas and oil, could make coal an obvious avenue as energy security remains a critical concern. For some of our interviewees, such a reliance on coal would lead to two outcomes: the continuation of centralised energy systems, and

the essential development of carbon capture and storage (CCS) technologies to remove carbon from the processes.

Yet others, such as David Runnalls, painted a picture of a more diversified future with a shift to local generation and supply based around renewable energy:

“Energy supply will be very diverse and highly localised. Fossil fuels will play a role; new gas sources may be discovered; coal use will decline... [There will be] lots of local decentralised sources like wind, solar, tidal, biomass.”

For developing countries, there could be a clear economic, as well as environmental logic to using local, renewable sources of power. Diverse sources of solar energy could seem obviously preferential when paralleled with costly, unreliable, centralised grids that might be reliant on foreign fossil fuels. Martin Wright, editor of *Green Futures* magazine, highlighted how some countries like Nepal and Laos are looking beyond the 'national grid' model outside of the big towns, and increasingly see decentralised generation as the future. Our Redefining Progress scenario explores how such a structure of renewables might boom. Whatever the popularity and adoption of renewables, the miniaturisation of existing processes as well as the development of new means to harness energy, will most likely reshape the sector into something completely unrecognisable from the early forms used today.

energy efficiency

Whichever approach is adopted, energy saving technologies are likely to play a critical role in any future. Amory Lovins has identified many of the technological developments that he believes will deliver a highly energy-efficient, very low-carbon but high-output economy. Richard Welford told us that many countries can learn from one and other: “China is a tenth as energy efficient as Japan. We can learn a lot from the Japanese approach to energy efficiency.” Ryoichi

“What technology might be important in helping to mitigate climate change? My top four are: energy efficiency; energy efficiency; energy efficiency; energy efficiency.”
Richard Welford





Yamamoto, professor at the Institute of Industrial Science at the University of Tokyo, forecast “at least a factor of two improvement over the next 20 years in energy saving technologies.”

The innovations that will spring from this drive have the potential to dramatically reshape economies. Peter Johnston emphasised how these efficiency technologies will grow in importance over the next decade:

“There is a wide range of technologies, mainly associated with ‘intelligent’ use. At the ‘appliance’ level, there is energy-efficient OLED lighting, energy-efficient PCs, TVs, washing machines, energy-efficient vehicles, and the plug-in electrical-powered scooter/moped. At the home/office/shop-level, there is intelligent building-system management. And at the business and societal-level, there is intelligent public transport – including car, bike, and moped-share in major cities – as well as intelligent business logistics, and office-space use, including hot-desking/e-work. There is also more use of electronic services instead of physical goods and ‘proximity’ services – electronic banking rather than local branch services.”

transport technology

In transportation, electrical power and the lithium battery have revolutionary potential. As one of our interviewees suggested, excess electricity generated by the movement of automobiles could actually be sold back to the grid, in turn promoting decentralised energy systems. California’s hydrogen car-fuel stations today are looked back on as the pioneers of the clean, personal mobility revolution in Efficiency First.

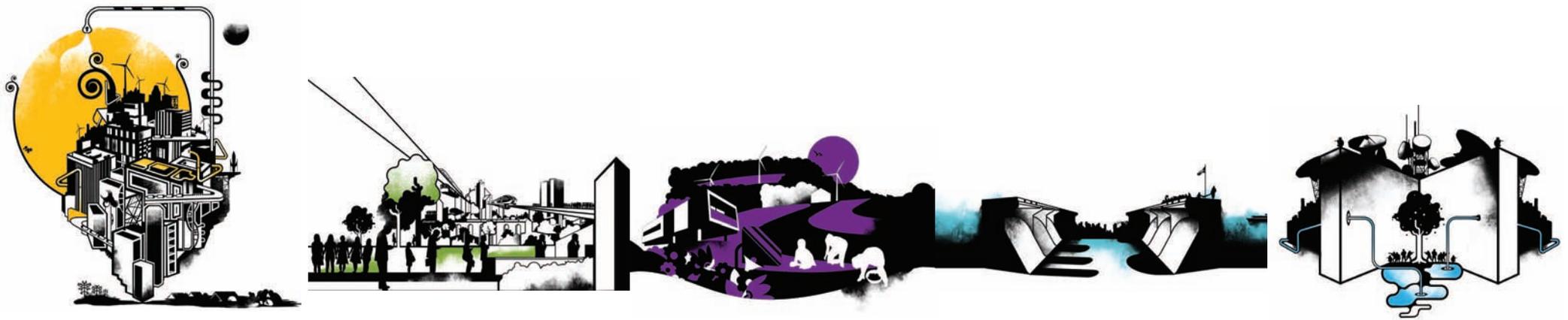
Alternatively, professor Young Ku suggested that developing countries could “skip the car-era and move to the next generation of transportation,” or see ICT reduce demand for transport. If the western ideal of ‘cars for all’ proves physically

impossible in the emerging megacities of China and India, innovative solutions could inspire a new challenge to the West. Paul Dickinson was more explicit: “I see us as being the last generation to do this ridiculous amount of travelling. People believe that videoconferencing has been tried and failed, but that is not the case... Dedicated bandwidth makes the difference. Currently, decent technology is at the ‘top end’ like the 1905 car industry; we need a Henry Ford to allow things to roll out and the network effect to happen.”

geo-engineering and adaptation

Geo-engineering technologies could experience rapid and high levels of investment, experimentation and adoption. In our research for this project, Alan Atkisson argued that at some point in the future, a shift in attitudes to geo-engineering was likely. According to him, arguments that such intervention could “muck-up the system,” will seem less powerful as it becomes increasingly clear that ecosystems have already been fundamentally altered by human intervention. Given the scale of the problem, he suggested that there could be an “ethical obligation” to consider geo-engineering as one of the options for responding to climate change. From cloud seeding to reflective mirrors in space, these projects are normally large-scale, as-yet untried and currently highly controversial. The potential for unexpected knock-on effects is the experience of the high-tech ventures of Efficiency First.

Finally, there will be a swathe of new technologies designed to help us prepare for, and adapt to, a climate-changed world – from drought-resistant crops, to highly specialised early warning systems for extreme events. For adaptation technologies in particular, how widespread the uptake is could be determined by whether or not successful innovations are shared between countries, for example through special funds. With varying degrees of availability and success, these responses are explored across our scenarios.



five scenarios for 2030

Our interviews and other research told us about the most important factors shaping the future response to climate change, and how they might develop separately over time.

The process confirmed that we shouldn't just think about what climate change might be like, but what a climate-changing world might be like – in all its social, economic and political complexity.

The scenarios in this section explore this. Each of the five worlds we describe below are, we believe, possible responses we could see to climate change over the coming decades.

- In **efficiency first**, rapid innovation in energy efficiency and novel technologies have enabled a low-carbon economy with almost no need for changes in lifestyle or business practice.
- In **service transformation**, a high price of carbon has ushered in a revolution in how peoples' needs are satisfied.
- In **redefining progress**, new priorities of wellbeing and quality of life are bubbling up across the world as more sustainable forms of living become established.
- In **environmental war economy**, tough measures have been adopted to combat climate change, pushing markets to the very limit of what they can deliver.
- In **protectionist world**, globalisation has gone into retreat and countries focus on security and access to resources at any cost.

We used a detailed methodology to help us create these scenarios.

Firstly, we researched the field, reviewing documents in the public domain. We used the information collected as the basis for a semi-structured interview, and we spoke to 42 people from across the world with a variety of different areas of expertise, including economics, policy, international relations, energy, international development, climate science, action research, environmental science and technological innovation.

The research gave us around 50 major questions whose answers will shape the response to climate change, such as: how open to behaviour change will people be? How effectively will low-carbon energy systems be deployed? Or how likely is an inclusive global agreement on climate change to succeed the Kyoto Protocol?

We then prioritised these questions at an interdisciplinary workshop and clustered them together under seven headings (with the acronym BEARPIT):

Business – the degree of engagement of the international business community with the climate change challenge

Economy – the state and shape of the global economy

Attitudes – the attitude of different societies and sections of society to climate change

Resources – the availability and price of resources, particularly oil.

Politics – the attitude of national governments to climate change, and the shape of any international agreement

Impact – the impact of climate change, and the scientific predictions of future impacts

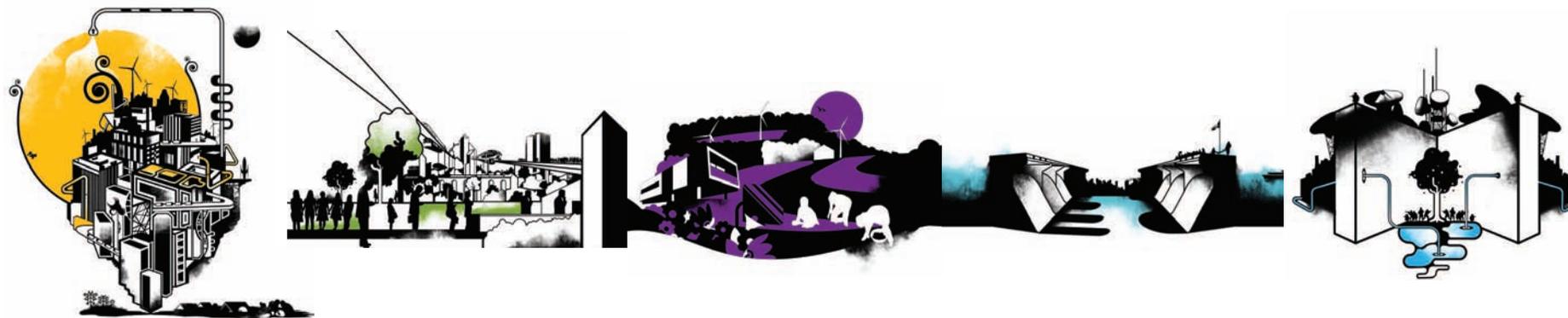
Technology – the degree of investment and effort in technological solutions to climate change, and how successful they are.

We used these headings to describe the current response to climate change in 2008, and then set three time horizons: 2012, 2020 and 2030. We asked what might change under each of the headings by 2012, and identified four possible worlds that could result – one where there had been a post-Kyoto agreement; one in which a region, probably Europe, led and the rest of the world followed; one in which business took the lead and governments followed; and one in which no concerted action of any note was taking place.

We then explored the different worlds that could emerge by 2020 from each of those four 2012 worlds, still using the seven general headings to guide us, and then repeated the process to take us to 2030.

In this way, we generated a ‘tree’ of possible worlds, starting from the trunk of 2008, leading to a branching of possible futures in 2030. Then we described each 2030 world briefly, documented the different paths that led there from 2008, tested them for plausibility in an interdisciplinary workshop, and encouraged participants to flesh out the characteristics of the worlds we had identified.

We initially identified nine different worlds in 2030, and then selected five that were different enough from each other to warrant further exploration. This involved creating a historical timeline based on a specific path from 2008 to 2030.



Finally, the scenarios were reviewed and refined by members of the team and external reviewers.

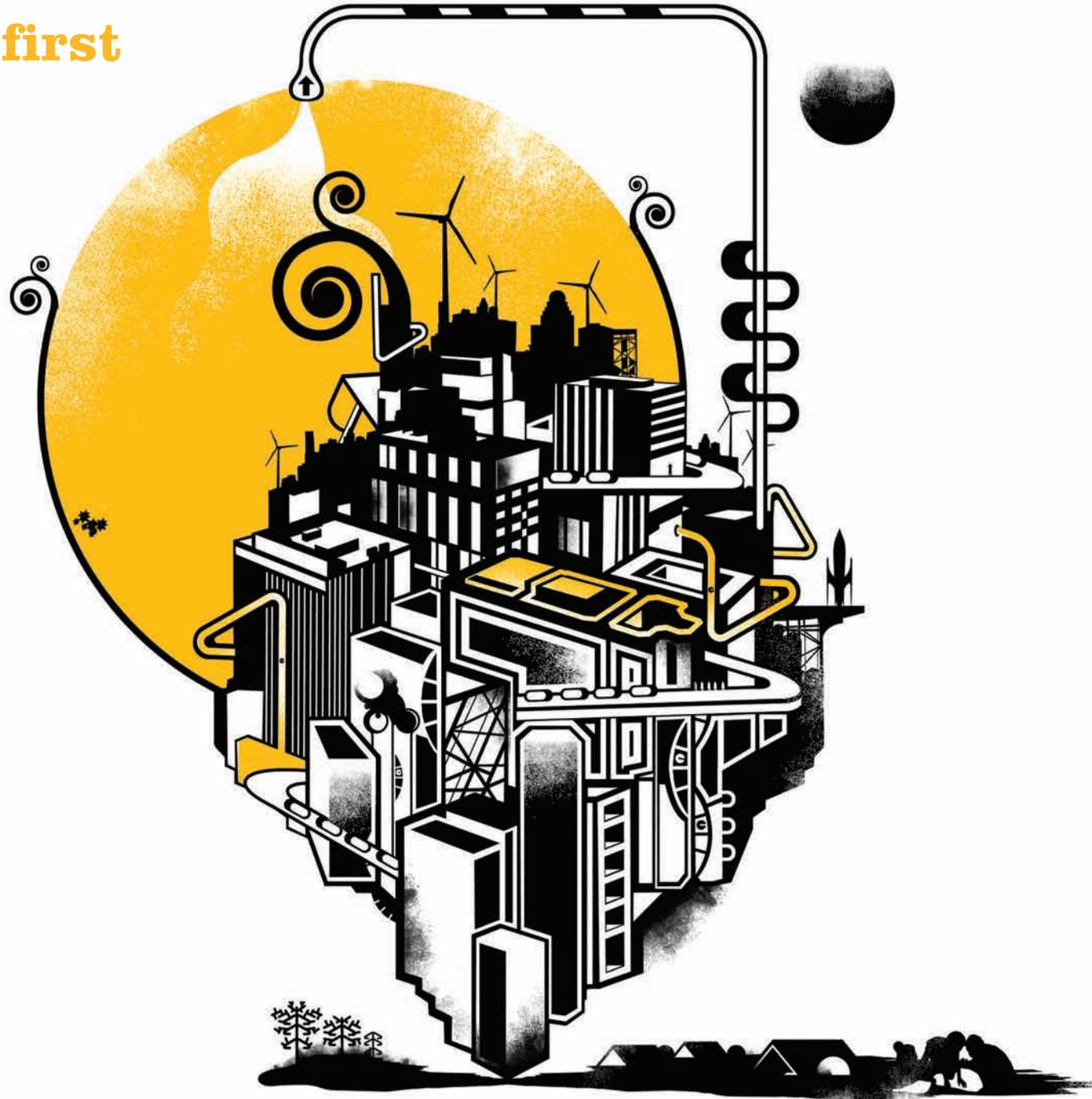
Our scenarios are not predictions and none is our favourite, though clearly some of the scenarios present stiffer challenges than others. They are stories, fictions rooted in the diverse views of today, but designed to challenge current thinking and provide a tool for considering the future.

For the scenarios to stimulate ideas for strategies or new products, they must be convincing. Readers should be able to imagine themselves in each scenario – although a certain willing suspension of disbelief might be needed.

In making the effort to stretch the mind forward 22 years to 2030, it might be useful to consider the scale of change the world has seen in the 22 years since 1986. The Cold War and Soviet Union have disappeared; Germany is united; international terrorist networks have emerged; a third of people in Africa now have a mobile phone; the internet has completely transformed media and communications; we think of ozone depletion as solved; and of course climate change has emerged as an issue of global importance.

We can expect that 2030 will be at least as different from 2008 as 1986 was from today.

efficiency first



1 efficiency first

Rapid innovation in energy efficiency and novel technologies have enabled a low-carbon economy with almost no need for changes in lifestyle or business practice.

The power of innovation has revolutionised the economy. A high-tech, low-carbon transformation is delivering dramatic cuts in greenhouse gas emissions while managing to sustain economic growth. Across the world, innovative business solutions appear to sustain the insatiable demands of eight billion people to consume more, grow richer and live longer.

The result is an increasingly individualistic, consumerist and fast-moving world. High levels of economic growth in the global economy for decades have only been interrupted by relatively minor downturns related to the availability of resources, and growth in the global South has been particularly marked. But overall levels of growth mask a growing divide between rich and poor people.

The world has seemed close to overheating for years, but somehow keeps going through developing novel efficiencies and more sophisticated ways of doing things – always adding to the complexity of systems. Some call this a golden age of technology and freedom, others call it a very shaky house of cards.

a history of the world

2009	The new US president declares a commitment to dealing with climate change but promises to protect the American way of life.
2010	An artificial replacement for paper is developed in China.
2011	China connects its 'last village' to the internet and the state broadcasts a celebratory message to 1.3 billion people.
2012	The IPCC's fifth assessment report is published, showing that the planet is on an accelerating trend towards dangerous climate change.
2013	A new international agreement on tackling climate change is signed, including the US, China and India.
2014	An affordable battery-powered car leads the Indian auto-market.
2015	A Chinese travel firm announces that bookings for its virtual-reality 'Bubble Park Holidays at Home' are selling as fast as overseas holidays.
2016	As California declares that carbon emissions have been reduced to 2000 levels, the governor announces that every citizen has access to high performance car batteries along the state's major highways.
2017	China signs an international agreement to collaborate on large-scale geo-engineering projects with the US and Europe.
2018	Extinction of the Bengali tiger in the wild.
2019	The G10 meets in Recife and recommits to tackling climate change. Market forces are the primary means of moving activity towards a low-carbon economy; growth becomes increasingly carbon-proof.
2020	Global greenhouse gas emissions flat-line.
2021	A US company claims it has used microwave energy from a satellite to successfully deflect the path of a hurricane off the coast of Florida. Three weeks later, a Chinese firm announces that it has used biodegradable oil slick on the surface of the China sea to 'sap the energy' from a typhoon.



2022	An Indian company signs a 100 billion euro contract to sell its 'sea push' technology, pioneered in Bangladesh to force water away from land, to the Netherlands.
2023	Sahara Solar, which supplies a quarter of Western Europe's power, is listed on the South African Stock Exchange and creates Algeria's first trillionaire.
2024	A two-year global economic recession. Taxes are raised worldwide, but targeting the remaining high-carbon firms, causing several to go bust and lay off thousands of workers.
2025	The world's richest man, Josep Aguilà, donates most of his fortune to the Terraform Mars Corporation in the belief that Mars will be habitable within his lifetime.
2026	Supercomputer Alf-8 correctly predicts general strike in France.
2027	Russia's leading travel firm unveils a new fleet of high-speed, self-sail hovercraft as part of their 'Quick Escapes in Canada' e-brochure.
2028	First bionic games inaugurated in Los Angeles.
2029	Simple-lifers hold the balance of power after elections in Argentina.
2030	Proposals are tabled at the UN to mine the moon for precious resources.

business

In a globalised world, the **business community has responded vigorously to the challenge of climate change** – not for altruistic reasons, but by operating efficiently within an elegant market framework that accounts for the damage that greenhouse gas emissions do to the climate. It is prohibitively expensive to emit greenhouse gases.

Business and the market are the prime vehicles for delivering policy goals, using the power of innovation. And even as constraints on the availability of raw materials tighten, creative corporate leadership delivers ever-more ambitious solutions for carbon reduction. New markets are exploited by entrepreneurs and investors leap at the myriad of solutions globally driving a healthy flow of international capital and sustaining growth.

Although governments have set the legal framework and established a **cap-and-trade system, competitive business is driven by self-interest rather than regulation.** Transformational change to the post-carbon world makes economic as well as environmental sense.

Global business alliances, supported by governments, collaborate to tackle the big challenges of the day – drought relief and water supplies, large-scale renewable energy projects, and ambitious geo-engineering ventures.

There is however a strong critique of this corporate world. The cuts in greenhouse gas emissions have been impressive, but this has been achieved without any sort of moral stance on climate change from business. Their actions have simply been a function of the market. It is, in the words of one commentator, an **'ethics-free low-carbon economy'** and 'a return to Friedmanite business mindsets'.

economy

Economic growth has been sustained more or less for decades, and has **lifted hundreds of millions out of poverty.** No major global depressions have taken place since 2009, to the amazement of even the most optimistic economic analysts, with periods of recession (chiefly related to problems with resource availability) short-lived. Part of this success has been attributed to **'cyber-governance', the use of autonomous software systems to monitor the economy and intervene** in policymaking to keep the economy on an even keel.

The gap between rich and poor has widened considerably and it is no exaggeration to say that there **are two worlds today: the world of hyper-consuming middle classes and the world of the underclass**. The two worlds exist side-by-side in almost every country on Earth. A vast underclass simmers in discontent, plagued by mounting problems of obesity, depression, crime and hunger. The global conscience seems almost de-sensitised to their plight, with food riots and famines – in countries that hadn't experienced such unrest for centuries – passing almost unnoticed.

Governments aim to **grow their way out of the problem of climate change**: to generate wealth that will fund new technologies that in turn will, it is hoped, save the planet.

China's economy is the largest in the world, with India second. The new middle classes in South Asia display a ferocious appetite for consumption that takes even the most well-prepared corporations by surprise. **The economy is more interconnected than ever**. Growth is sustained by fast cycles of innovation that provide products and services to new markets across the world.

Yet the rise of countries like China and India has also reversed historic flows. **New ways of doing things, and novel solutions to climate change, emerge first out of the East**. These corporations – winning geo-engineering contracts and delivering outstanding energy solutions – provide an aggressive challenge to western economies.

attitudes to climate change

The importance of climate change is recognised universally – thanks in part to the last 18 years of steadily strengthening international agreements on climate change mitigation and adaptation.

Radical reductions in the amount of greenhouse gases being emitted in the past decade or so have **led many to think of climate change as a problem that has been, or is quickly being, solved**. As a consequence, it is descending the list of priorities.

Many environmentalists' credibility has taken a severe beating. Campaigning groups, while supporting cap-and-trade systems and a high carbon price, argued long and hard for a more holistic solution that addressed the root causes of climate change and many other environmental problems. Yet the most striking characteristic of today's world is the **resolute determination in societies across the globe not to alter their high-consumption lifestyles**. Americans want to consume more for less, while the developing world seeks to emulate their success.

Meanwhile, it is considered acceptable to support massive geo-engineering projects to reduce greenhouse gas emissions, remove the gases from the atmosphere and intervene directly in climate systems to reduce global warming, despite a near-disaster occurring when experimental releases of sulphur dioxide into the upper atmosphere caused severe local depletion of the ozone layer. Proponents argue that **we live in a world where natural systems no longer exist separately from human systems**, due to millennia of co-evolution, and so direct human intervention of this sort is justified.

resources

Although many people feel that the world is on track to solving climate change, other environmental problems, in particular related to the availability of resources, are creating major difficulties. Prices for raw materials are very high and getting higher, having major impacts on manufacturing processes and the world economy.

The search for new sources of raw materials is relentless and takes prospectors into every corner of every continent and the deepest oceans. Proposals have been tabled for commercial mining ventures on the moon. At the same time, the world is racing to develop new processes and new technologies that obviate the need for so many raw materials. Many techniques are based on nano-scale engineering. **The world is in a deadly race to develop new processes before resources run out completely**. Just as resource becomes prohibitively expensive and looks set to run out, a new way of doing things appears and creates more opportunities.





Few innovations are off-limits – **artificially-grown flesh now feeds hundreds of millions of people**, massive desalination plants in the Middle East and North Africa soak up vast quantities of solar energy and irrigate the desert, and genetically modified crops and livestock are the norm.

Yet some resources are drained irreversibly. And as the complexity of human systems increases, the natural world is eroding. Biodiversity collapse is common in most habitats. **Wilderness hangs on only in the tiny isolated pockets where it is genuinely protected, and even the most remote areas of rainforest and tundra have been degraded.** Vast plantations have replaced old-growth forests, and many species only continue to thrive in zoos and game parks, in gene banks and in virtual environments.

politics

Despite the **natural inclination for small government**, politics has been crucial to setting the long-term framework, timetables and targets that have delivered the changes seen today. Internationally, leaders cooperate on mitigation and adaptation measures: the global cap and trade system; new geo-engineering projects; and in sharing priced technology.

Successful national governments demonstrate how they can reduce emissions without harming their economy. But many of **the most inspiring examples come not from the state level but from local leaders in the regions, states, and cities across the world.** These pioneers demonstrate how their low-carbon visions can bring jobs, investment, and continued economic prosperity alongside tackling not just global carbon emissions, but also air quality, public health, and energy security.

However, **international consensus looks increasingly at risk of fracture.** Divisions are beginning to open up over the best means to tackle climate change, and where priorities lie. Some countries estimate they would benefit from a **return**



to pre-industrial concentrations of greenhouse gases and so plan for that, while others pursue higher concentrations in the belief that would suit them better.

There is a **growing international counter-culture advocating a 'return to simplicity'**. The crudest expression of this trend is the burgeoning number of products and services designed to reconnect the consumer to the land or to nature. Deeper concerns about 'cutting of the chord' with the natural world fuel a vigorous political movement, which began in the US but quickly spread around the world, forming a new 'fifth column'. **Whole new communities of 'simple-lifers' have sprung up in remote areas of Canada and Siberia.**

Meanwhile the labour movement has experienced a renaissance, fuelled by discontent in the global underclass.

impacts of climate change

The impacts of climate change are clear right across the planet. The IPCC's fifth assessment report, published in 2012, drew together overwhelming evidence that the world was on an **accelerating path towards dangerous climate change.**

However, concerted global **effort to decarbonise the economy has had startling effect.** Growth in greenhouse gas emissions began to flat-line in 2020 and then decline slowly even as the global economy continued to grow. The prognosis is not exactly good, as there is still a lot of climate change to expect as a result of historic emissions, but there is talk of climate change being yesterday's problem. There is even the prospect of extracting large amounts of carbon dioxide from the atmosphere and artificially returning to pre-industrial levels.

If future climate change is being effectively mitigated, **the world still needs to adapt to more severe and unpredictable weather, higher sea levels, hotter summers and shifting rainfall patterns.** This is done through investment in massive engineering projects. For example, much of the US eastern seaboard is

now protected from storms by eco-concrete walls that generate power from waves and tidal surges. Poorer areas of the globe are less well protected and it is here that human suffering from climate change is greatest.

technology

Technology is the driver of transformation. This is a **new age of optimism for technology**, where the limits of innovation appear constrained only by the imagination. It seems that wherever the challenge is greatest, the innovation is most creative.

Technology to address climate change focuses chiefly on creating **more efficient versions of what went before**. So people still own cars, but the cars employ technologies that make them almost carbon-neutral (in most cases this is achieved through using hydrogen fuel cells or highly effective battery technology). When in the 2010s the EU began to suggest that people sacrifice personal mobility and adopt low-mobility lifestyles or use public transport, **governments in the South rejected their entreaties as neo-colonialist and backward**.

Technologies that have been particularly effective in reducing greenhouse gas emissions include:

- super-efficient thin-film solar cells
- electric cars
- scrubbers (to remove damaging pollutants from emissions)
- algae-based biofuels
- smart-dust for fine-grained, real-time environmental monitoring
- supercomputers able to design more efficient systems and processes.

Technology is at the centre of life. 'Exascale' computing speeds, combined with breakthroughs in the modelling of social systems, mean that autonomous software is trusted to **advise on policy, business strategy and even personal lifestyle choices**, testing ideas against highly complex and detailed virtual societies that replicate the real world with great accuracy. **Bionics is the main growth area in medicine**, and in 2028 the first bionic games was inaugurated in Los Angeles.

Virtual environments provide people with the access to nature and adventure that has become nigh-on impossible in a real world of eight billion consumers.

Massive, internationally collaborated, geo-engineering projects help mitigate the impacts of climate change. African entrepreneurs create a bright future with large-scale solar power and Middle Eastern governments collaborate on privately funded desalinisation projects in water-stressed areas.

In energy generation, low-carbon solutions are rolled out across the world. Large-scale renewables mix with nuclear and carbon-capture and storage, the diversity reflecting different national priorities. In some areas, large-scale renewable energy generation leads some to predict energy efficiency measures are no longer needed. Such renewable energy is so cheap and widely available in places like North Africa that **reducing energy use no longer seems a top priority**.

the role of the ICT sector

In a highly technological world, **ICT plays a crucial role and is considered the top priority infrastructure, above transport and any other utility**. Networks are truly ubiquitous, with mini-satellites picking up gaps in network coverage and peer-to-peer networks providing effectively limitless bandwidth. Processing power is also huge.

Supercomputers are used in decision-making and lifestyle advice. Robot pets are popular in the small apartments of the world's vast megacities. Convincing virtual environments are used everywhere for meeting (using avatars, replacing video conferencing) and gaming. Virtual gaming has become so sophisticated that it is the **main leisure activity for millions of today's families**, replacing day-trips, cinema and holidays.

Nanotechnology and ICT have converged to the extent that **'smart dust'** – tiny motorised processors with transponders – can be released into the environment. They can persist for years (and are a potential pollutant) deriving energy from their surroundings, moving about and communicating information. They are used for environmental monitoring as well as security, reconnaissance, and disaster relief.



service transformation



2 service transformation

A high price of carbon has ushered in a revolution in how people's needs are satisfied.

Carbon is one of the most important and expensive commodities in the world today, unleashing unprecedented levels of creativity across the global economy. Companies have rewritten their business models to meet underlying needs, often by selling services instead of products. This is a new type of consumerist world, one with a 'share with your neighbour' ethos.

Europe led the way with its Energy Independence Initiative, driven first by concerns over energy security. The continent's successful new models in infrastructure and business have been exported around the world. Today, washing machines are too costly, so advanced collective laundry services

are more popular; individual car ownership is unaffordable and undesirable, but rent-a-bike and rent-a-car are booming and mass public transit is hugely successful. Rental services – which offer all-in-one maintenance and waste collection – are widespread for electronic goods.

India is a service hub, which has prioritised the roll out of 'zeta-broadband' to its villages over and above investment in roads. The dramatic transformation in business has been painful for some, with rising unemployment in the old high-carbon sectors. The US legacy of individualism – from urban sprawl to cleantech innovation – has resulted in a comparative struggle to cope with stripping carbon out of its economy. Booming mega-cities are only just managing to cope and fuel poverty is a huge problem.

a history of the world

2009	The new US president promises to fight recession before climate change.
2010	Russia temporarily switches off the gas pipeline to Europe during a dispute in mid-winter. European leaders are shocked into promising energy independence by 2020.
2011	The 'Copenhagen Agreement' is signed. Despite bold words in advance, the agreement has no more 'bite' than Kyoto. Corporations lobbying for the status quo prove more powerful than citizen pressure and the more progressive voices from business. China pushes hard for climate-compensation and technology transfer.
2012	The 'cleantech bubble' bursts. Europe develops a tough regulatory framework, which primarily uses markets to create energy independence.
2013	The rise of Chinese and Indian car companies, combined with costs from pensions, almost bankrupt Porsche-VW (which includes Audi, Bentley, Lamborghini and truck maker Scania). As part of its re-invention, it transfers manufacturing to China and creates a new public-private division that focuses on urban mobility in Lower Saxony.
2014	Population growth in the global South creates unprecedented demand for commodities and consumption. New capacity can barely keep up, so commodity prices reach new highs.
2015	British celebrity Lei Harris, the new James Bond, is part of a wave of celebrity 'non-owners'. Interviews focus on how much freedom he has because he has so few possessions and can get what he needs from various 'experience' companies.





2016	'Hot car' carpool models have become the dominant means of transport for residents in Paris, Berlin and London.
2017	Economic growth is consistently higher in Europe than the US for the first time in 50 years, and decoupled from energy use. Labour productivity growth has been higher for five years, underpinned by carbon and resource productivity. There is talk of the 'European performance miracle'.
2018	The world experiences a series of dramatic and devastating climate change events: extensive water shortages in China; forest fires and failing crops in the US; floods in India and Europe. Billions are affected across the globe and scientists closely link the events to climate change.
2019	Pressure for an effective, global agreement on climate change is intense. Pro-agreement parties are elected across the world; businesses that can see how they will profit are campaigning vigorously for a global agreement. All eyes are on Europe's transformation from consumer to experiencer.
2020	The Beijing Climate Agreement is signed by leaders from across the world. It is an ambitious, binding and strictly-enforced global framework for mitigating carbon emissions.
2021	European energy independence is declared, only one year late. There is a 'closing ceremony', where the gas pipe to Russia is switched off.
2022	Tata join forces with VodaBTfone to lay zeta-broadband networks across rural India as the primary infrastructure; cheaper and more beneficial than roads.
2023	The US Department of Homeland Security enforces its Adaptation Plan. Much of Florida is protected by adaptation works paid for by government bonds.
2024	Global carbon emissions decline while global economic growth continues for the first year in history.
2025	Another year of bewildering climate behaviour as temperatures in Libya break 60°C – 140°F. Scientists warn that that the world is close to runaway climate change.
2026	NATO defines 'breaking the Beijing Agreement' as an attack on all its members, which can be defended through military force.
2027	Fortune500 is dominated by companies from the Service Transformation Economy.
2028	The virtual Olympics. Athletes stay at home and compete against each other in virtual space. It's the largest Olympics ever and a great success – attended by billions of spectators from all over the globe – all thrilled at being 'there'.
2029	The Re-Forestation Alliance, funded by a Beijing agreement mechanism, report only minor success in reviving the rainforests of Brazil and Indonesia.
2030	The Second Beijing Climate Agreement. The world feels so close to runaway climate change that efforts to decarbonise the economy are redoubled.

business

The priority for businesses today is to maximise profit for every unit of carbon used. Most surprising has been the rapid and perpetual change in business models: dramatic and far-reaching, the winners and losers emerging across the globe have been surprising.

The most prosperous businesses are those that have gone beyond simply using less energy and instead transformed the very way they do business. The innovators asked: **what do my customers really want, and how can I deliver this in the most cost-effective, low-carbon way?** Meanwhile, those businesses that assumed endless, cheap supplies of energy in production, transportation or use of their commodities are suffering. In some places, governments have had to step in to protect those of strategic importance amid signs of collapse.

Companies have found ways of selling performance. In cities, people don't own washing machines, they use a door-to-door laundry service. They don't own a car; they use the urban mass transport system or are members of a car-pool. People don't go for a weekly shop; perishables and regular items are ordered remotely and dropped off at their home. Mobile phone operators offer a 'rental and return' contract that recycles and re-uses all components. An Indian manufacturer is leading the market with a **guaranteed maintenance and replacement services** for all sales of electronic goods.

The business-to-business market also focuses on 'performance services'. **Specialist companies offer a 'rent-a-molecule' business, lending a material to a manufacturer for return at the end of the product's life.** This is the preferred business model for nanotech products that maximise the performance of everything from clothes to personal gadgets. What were previously major construction companies are now sophisticated technology service operators delivering '**energy sufficiency**' in buildings.

Businesses are profiting from selling prevention or absence. In some critical markets, such as energy, regulatory arrangements mean companies can **make more profit from selling less.** There are financial markets that can match 'carbon risks', so if there is too little sun for your street's solar panels energy can be received from someone who had an excess.

Companies are **inventing materials that offer outstanding value for every unit of carbon** generated: catalysts, high-yield GM crops (some for food, others for raw materials), nanomaterials and superconductors. The virtualisation of paper has rendered pulp manufacturers obsolete. Massive investments are pouring into finding the ideal artificial replacements for metals and glass.

Other **businesses are profiting from managing performance of products over time,** rather than designing in obsolescence. Electric light bulbs and new LEDs are durable and highly efficient. They are also managed as a 'fleet': one company offers a service of remote monitoring of their performance in the home

or the workplace, replacing them before they fail and recycling them at the end of their life.

Product life-extension is ubiquitous, re-using, re-manufacturing and renovating as much as possible. Closed loop models are also widespread, where production waste and end-of-life products are recycled. In fact, when goods reach the end of their life there is competition for their materials. The **thriving recovery markets** for materials that are energy-intensive to extract or make, such as metals, are evidence of this new value. Some companies use pervasive computing and global positioning technologies to track and make sure they get back 'their' materials, while **peer-to-peer businesses match disposed materials with companies who need them.** Energy-intensive sectors, like smelting new aluminium or steel, are only possible if the producer has control over a renewable energy source, like a dam.

For some time, companies from emerging economies have developed particular expertise in extracting the most from limited resources. These global giants have expanded rapidly on the back of cashflow and expertise gained in their home market.

economy

The economy is maintaining impressive rates of growth worldwide, and is more interdependent than ever before. But this is a distinctly multi-polar world, where each part has its own specialist contribution to the global economy. The Beijing Climate Agreement signed by the world powers in 2020 has caused dramatic changes over the last decade. For example, **the nightly news in every country lists the global carbon price, not the oil price.**

Europe focused on the Service Transformation economy from 2011 and as a result has been able to lead in the carbon productivity sectors that have transformed how people meet underlying functional needs. Europe thrives by exporting this expertise; Japan's similar path provides alternative solutions to the worlds markets.





A patchwork of shared infrastructure enables this economy. Major European and Japanese cities have addressed urban mobility with a mix of measures. Firstly, by reducing the need to travel through urban design that mixes living and work areas with extensive zeta-broadband networks. Secondly, the number of options of how to travel has been dramatically increased, with attractive walking routes, cycle tracks and communal bikes, enhanced public transport systems such as trams and ubiquitous quick-book rent-a-car networks. Each of these services is underpinned by the power of pervasive computing and global monitoring systems: people query their mobile devices confident that they will be **guided to the best transport option available**.

The benefits have been wide-ranging. **People no longer lose time in commuting or travelling to meetings**. Autoconvoys, linking cars on highways in virtual convoys, has freed up the roads, with major environmental benefits. The investment in infrastructure was financed by bonds, which are paid for both by carbon taxes and the longer-term forecasts for savings in health spending following improvements in air quality and more active populations.

Peer-to-peer networks promote collaboration across supply chains. Consumers travelling long distances routinely agree to carry high-value shipments on behalf of trusted companies. Logistics companies have advanced **auctions to sell off spare space** on longer voyages.

The US is playing catch-up. It remains a key player as the world's hub of capital markets with a historic capacity for innovation. Indeed, it has excellent low-carbon technologies thanks to the legacy of bilateral agreements and the cleantech bubble. But the products developed over the last two decades mostly focused on individual use rather than shared infrastructure – the improved home washing machines rather than industrial units more suitable for laundry services, as well as the legacy of investment in carbon-intensive infrastructure throughout the 2010s. The dramatic transformations have caused rising unemployment in some of the old high-carbon sectors. These **legacies are now hitting US competitiveness in today's carbon-constrained world**.

South-East Asia is the world's manufacturing hub. The high price of commodities through the 2010s and water and other resource shortages

combined with additional labour costs to put a premium on resource efficiency. As a result, South-East Asian companies can make products efficiently and innovate throughout their supply chains. China's five colossal Industrial Ecology parks are an example to the world of how waste from one company is 'food' to another. At the same time, China finds itself **unpicking some of the economic developments of the early twenty-first century** – such as the dramatic expansion of the coastal cities– in order to deal with the global carbon price.

India is the world's services hub. In the 2020s, the government prioritised its services infrastructure like zeta-broadband alongside investment in roads or rail. As a result, it was able to bring access to the global economy to its rural population, and in so doing has helped stem the flow of migration from villages to the cities. Yet few of these innovations have reached the 'hinterlands' in Africa, Latin America and rural China, where businesses now look for the next opportunities for efficiency innovations.

attitudes to climate change

Across the globe, mindsets are united in the face of dangerous climate change. **People share an attitude of acting together** in order to prevent a further drive towards 'runaway' climate change. The experience of looking 'over the edge' in 2018 and again in 2025 offered a glimpse of climate change: the dramatic series of droughts, forest fires and floods resulted in the loss of life of millions worldwide.

The uncompromising message from scientists and the media has perpetuated this consensus: carbon needs to be controlled at all costs. Scientists speak regularly of 'the Carbon Cliff', warning that if we "drive the world over the Carbon Cliff, we'll have runaway climate change." The science is more and more certain about where the Cliff is.

This attitude underpins global political action and individual behaviour. Some **communities of 'non-owners'** have pledged only to rent goods or use services. But there is also a faint nostalgia for things past that are no longer available. The out-of-season fruit and weekends away based on cheap short-haul air fares are missed by some. Some books, media shows and interactive games portray a 'naughty nineties' where life was supposedly more carefree and individualistic.

Others react against these taboos through conspicuous consumption and flaunt their products and gadgets.

Europe is looked to as a low-carbon economy where people have their needs and wants met. People are prepared to change how their needs are met, because the European example seems to show you don't have to change what those needs are. The higher levels of collaboration create stronger communities: **energy, food and waste needs are solved through communal investment and solutions.**

Mainstream political decision-makers and commentators frame **mitigation measures as means of 'creating freedom for the future'**. The

World Economic Forum – whose membership is dominated by companies from the new service transformation economy – believes that markets should be channelled to the goal of giving the future freedom.

Meanwhile, other commentators suggest the Service Transformation economy is a 'perversion of freedom' that constrains free choice, blindly leading societies towards a new '**road to serfdom**'.

resources

The world has begun to move on from the era of high resource prices. Growth in population and consumption per head through the 2010s put severe demands on the supply of commodities such as oil. Governments and companies struggled to build the capacity that would bring the price down.

The Beijing Agreement in 2020 started to unwind that situation. Europe had already combined economic growth with reducing absolute energy and other raw material use. China and India followed suit.

Some parts of the world – central Australia, Oklahoma, parts of rural China – have been more or less **abandoned because of water shortages**. People migrated to the ever-growing mega-cities, which are only just managing to cope thanks to novel infrastructure innovations.

Food has been a worry in the past. However, since 2025 new crops have been able to produce a sufficient yield without carbon-intensive inputs such as fertilisers or weed-killers. Campaigns in China have created a **new generation of patriotic vegetarians** whose energy-efficient diet is cheap, tasty and popular.

politics

Mitigating climate change has been of the utmost importance to politicians for the last decade. The events of 2018 provided renewed impetus – and intense pressure from populations – for action to tackle the emerging problems.

The landmark agreement signed in Beijing in 2020 provided a binding and ambitious global framework for mitigating emissions. While there is some flexibility for different regions, the stick comes in the form of strict trade sanctions for offending signatories. It was backed up in 2026 when **NATO defined 'breaking the**

Beijing Agreement' as an attack on all its members, which can be defended through military force.

Different governments use different approaches. Markets are preferred. China uses social engineering to influence behaviour; Europe has banned some carbon-intensive activities, but usually as they were falling out of fashion anyway.

The events of 2018 had a profound impact on global citizen movements that champion activities to combat climate change. With the signing of the 2020 Agreement, the movements fragmented around alternative focal points, but still command significant power and influence. Some have formed large 'Non-owners Groups', who use influential combined purchase power to provide extra impetus to the service transformation economy. Where a particular place is under severe threat from climate change events, some **climate change extremist parties clamour for compensation.**



impacts of climate change

The impacts of climate change have been startling. Looking back, the 2010s appear a 'lost decade' when US, India and China prioritised energy-intensive growth. But it was the extreme turbulence of 2018 and 2025 that has characterised the climate's modern history.

In June 2018, images emerged from peer-to-peer networks of the extreme heat and water shortages in the Hubei province of China. The heatwave was prolonged and caused further droughts across the country. Meanwhile, the US was forced to declare a national emergency after forest fires wreaked havoc across California and caused the evacuation of millions. Crop failures combined to create one of the most devastating years for natural disasters in American history. Meanwhile, ruinous floods paralysed much of Europe. Again in 2025, heat waves shocked the world: Libya broke a new world record with temperatures breaking 60°C.

Collectively, 2018 and 2025 are looked back on as the moment when the world looked 'over the edge'. The new fear combined with real determination created impetus and widespread support for a strong, binding and strictly enforced global agreement on climate change. This has reinforced and maintained political and societal support for today's high and rising price of carbon.

technology

Some old technologies have effectively been 'retired'. The price of emissions means that new **technologies have to pass a carbon-benefit test.**

Today's technologies have **a focus on meeting people's underlying functional need** with as productive a use of energy and resources as possible. In transport, technologies focus on substituting the need to travel, such as 'You're There' virtual communications, alongside moving people more efficiently. Goods are designed with future flexibility in mind – often modular and always easy to re-use or recycle. Breakthroughs in nano and bio-technologies have helped with these developments.

Electric engines and pumps are extraordinarily efficient and closer to 'theoretical maximums' than ever before. New ways to save energy in batteries and other stores have also been developed, stored directly from generation as well as better means of conserving unused excesses.

Energy comes from a variety of sources, but the vast majority of generation provides no overall emission of carbon into the atmosphere – it is simply too expensive to do so. The cost of energy has inevitably been passed on to consumers and businesses. **In many countries, fuel poverty is a huge problem.** In Europe, India and Japan, a distributed grid of local production from renewable sources satisfies a significant proportion of demand for power, with communities



willing to band together to produce low-carbon energy. Some of the base-load is still supplied by nuclear, a legacy of developments in the 2010s. China and the US rely on coal, but all emissions have been captured and stored since 2022. Renewable generation across the world is being developed as rapidly as possible; diverse networks share and sell distributed generation from wind, solar, fuel cells and bio-waste.

the role of the ICT sector

ICT is seen as an important **enabler of the services economy**. Computing power has increased enormously, as has the ease of interface and physical reach. Being online, all the time, wherever you are, is so normal that people don't talk of being online anymore.

Much travel has been substituted with personal communication. ICT allows businesses to monitor the performance of products and services in real-time, managing fleets from afar. Micro-adjustments can be made that maximise efficiency and monitor when objects are entering the last phase of their current life.

ICT has two advantages as a platform that underpins economic life. Firstly, its energy use is from 'stationary sources' and it is well understood how to ensure these have no emissions. Secondly, much that is important for the economy can be translated into pure information for storage. This encourages server plantations, based in cold areas, which are the hubs of economic activity.

Aspects of ICT have become a utility, a regulated public service just like a water company.

Personal gadgets are used to maximise carbon productivity – such as getting a desired tram at the right time. These gadgets form part of how people express their individuality; they are often modular, high efficient and always durable.



redefining progress



3 redefining progress

New priorities of ‘wellbeing’ and ‘quality of life’ are bubbling up across the world as more sustainable forms of living become established.

This is a ‘wellbeing economy’ that highly values meaningful work, low-impact lifestyles, more time with family and friends, better health outcomes, creative educational experiences and a stronger sense of community. Countries prioritise economic and social resilience over the idea of economic growth.

During the global depression of 2009-18, new forms of living were born out of necessity. Individuals were forced to scale down consumption and prioritise meeting their immediate needs. Communities favoured local knowledge and looked to their own members to provide goods and services. As the world emerged from the depression, these new ways of living survived: from lower impact lifestyles to advanced networks that informally provide for needs at a local level.

a history of the world

2009	Economic recession caused by the ‘credit crunch’ entrenches across the world as oil and commodity prices continue to rocket.
2010	Silicon Valley cleantech bubble bursts.
2011	Clubs sharing skills in DIY, cooking, gardening and crafts like knitting are firmly established in the major towns and cities of the world.
2012	An international meeting to tackle climate change fails to reach an agreement as fears over a prolonged recession bite.
2013	The EU launches ‘Slow Down’ – a mass public health campaign aimed at slowing busy lifestyles and healthier eating to reduce stress and circulatory diseases.
2014	Depression deepens in cities worldwide with mass unemployment, and harrowing evidence of malnutrition across the world.
2015	Across Europe, government procurement strategies are rewritten to prioritise local providers to shore up economies and reduce costs.
2016	Cities in the developing world report evidence of populations leaving to return to rural areas.
2017	Authorities warned to prepare for a ‘suicide epidemic’ in the US caused by the depression.
2018	China’s thirteenth Five-Year Plan includes an indicator of ‘General Contentment and Wellbeing’ for the first time.

This is not a post-capitalist society – people work, consume and profit in markets. But citizens view money as a means to different ends and active governments tightly regulate the economy. Nor do communities experience isolation cut off from the outside world. Mindsets are intensely connected worldwide through global communications – different cultures learn from one another, Eastern mindsets infuse with the West, and diverse faith communities find common cause in advocating simplified consumption patterns and more sustainable lives.

But happiness is not universal. ‘Free-riders’ – quick to abuse the goodwill of others – profit from collective agreements, plunder resources and exploit the vulnerable. Several large cities have set themselves up as ‘havens of real capitalism’ and some governments have adopted an aggressive ‘pro-growth’ stance. In the communities hit hardest by the depression, many poor and excluded people remain isolated, shunning offers of support in a daily struggle to survive.

2019	Nobel Economics Prize awarded to academic who demonstrates how a low-growth economy has helped increase quality of life in India.
2020	The CEO of a major retail firm is sacked after the media reports unsustainable wood sources have been used in the construction of a new store.
2021	World Bank identifies Bhutan as most resilient economy on earth as health and education outcomes appear to be improving during the depression.
2022	A general retailer in the UK announces that it has sold more wool for home use than manufactured knitwear for the first time in its history.
2023	New figures reveal attendance at spiritual and religious groupings worldwide is undergoing an unprecedented resurgence.
2024	A technology firm scraps plans for 'yearly upgrades' to its leading communications system and instead declares it will offer a 'package that lasts for a decade'.
2025	Following successful research trials in Sweden, the UK and Hungary, the teaching of a secular mindfulness meditation combined with cognitive behavioural life skills becomes part of school curricula across much of the EU.
2026	America's largest consumer goods firm announces that it will record customer wellbeing as a key indicator in its Annual Report.
2027	Russia's 'pro-growth' party is re-elected by the narrowest of margins, prompting protests in Moscow demanding a recount.
2028	Paris begins monitoring prescriptions for depression in real time in order to direct government responses rapidly to critical locations.
2029	New President of South Korea elected on a promise of 'zero growth' to focus the state's resources on spreading prosperity and quality of life instead.
2030	Concordat of major religions makes statement about the values of living simply, for the sake of humanity, nature and the soul.

business

The business of business has transformed substantially. **Society today views complexity as a hindrance.** Lives are slower and experiences more considered – a refined form of capitalism – as consumers seek a clearer focus on needs, values and sustainability.

The past era of 'western' mass consumption is looked back on as one of **gross excess, exhausting choice, crippling debt, intrusive advertising, vacuous celebrities and useless technologies** that were out-of-date before they became affordable. Luxury markets and high-turnover industries have shrunk and the monolithic providers associated with the decadence and triviality of the past have gone bust. Slower solutions have become status symbols. Labels proudly display how long products took to make; handcrafted, slowly made goods are the height of fashion.

Today, local fruit and vegetables outsell imports in most countries. Energy sources are localised and personal; eco-efficiency takes centre stage. New forms of community living – from co-housing projects to community cooking clubs – foster **sharing and wellbeing**, as well as saving time, money and energy.

In the US and Europe, shifts are occurring across industrial sectors. Allotments and community farms are managed by families, volunteers and small businesses. The 'neo-cottage industry' of craft manufacture has grown to levels not seen for 150 years. Local and informal providers – many born out of the recession – deliver retail, finance, healthcare and transport. **Neighbours and online contacts are increasingly seen as the first port of call** for everything from exchanging ICT equipment to receiving medical advice.

For the workforce, the time-consuming and high-stress jobs of the past have been succeeded by **more time for leisure, culture, volunteering and family.** The average working week in the US today is 25 hours and most commit up to ten

hours to voluntary work in their local communities or online. Outdoor activities are booming, and new forms of culture-rich and active, exhausting online and offline hobbies are hugely popular.

The opportunities for those businesses that understand today's world are immense. The catchphrase of the boardrooms is **'grow smarter, not faster'**.

Successful businesses try to meet the needs of individuals; improve health and wellbeing; contribute to the values of society; and champion long-term sustainability. Despite the death of excessive consumption, today's heterogeneous products, suppliers and markets mean that **brands are more important than ever**. Prosperous firms emphasise not just their good deeds and well-managed companies, but also the authenticity, sustainability, history, locality, culture and even the 'spirituality' of their brands.

Citizens expect businesses to meet a clear social purpose. Governments play an active role in regulating the energies of companies into wider public realms. **Business is expected to help employees lead more fulfilled, happier, healthier lives** that create a positive impact on the community.

Transparency is at exceptionally high levels as business is subject to intense public and press scrutiny. Online debates forensically dissect corporate policy and societal contribution. Reporting and monitoring is strictly enforced in many countries: on resource efficiency; energy use; carbon emissions; and social impacts.

Traditional models have blurred with not-for-profits so it is often unclear where one motive ends and another begins. In Africa, a strong effort to recover from the devastation of the depression has opened up new markets for entrepreneurs who fulfil this dual purpose. Meanwhile, multinationals collaborate and syndicate with local and informal service providers in networks that distribute, maintain, recycle and inform about their business offerings.



economy

The globalised economy is locally focused and hugely diverse. Growth rates are more moderate than those experienced in the twentieth century and recent legislation has sought to curtail flows of capital and dampen speculative currency trading with a **Tobin tax on currency and commodity trade across borders**.

Not all regions and people seek the same priorities. **Russia and newly independent Texas have both adopted aggressive pro-growth stances**.

But flight of industry and capital to such places is less than expected as the global demand for high-value, high-consumption goods fails to recover to earlier levels.

Today, the citizens of the global South combine slow rates of economic growth with a relentless focus on social progress, quality of life and living within environmental means. The **'old model' of growth at the expense of social progress is castigated** by political leaders. The urban rich in the North, locked in complex distribution systems, find themselves looking to the South for strategies to cope with the depression.

attitudes to climate change

Climate change is well understood, but viewed as a part of a wider problem of unsustainable living. Scientific and sociological experts are widely respected as wellbeing and sustainable economics dominate the mainstream. But the part that people, companies and governments play in tackling climate change is debated intensely, alongside the problems of access and shortages of resources, poverty and inequality.

Around the world, **spirituality and religion are undergoing a historic resurgence**, but not in the formal sense. Instead, personal experiences, often through informal groupings, help people to explore concepts of individual and social development, meaning and purpose. Religious leaders and informal communities are united in advocating a move to a less complex form of life that prioritises contentment and sustainability. This message, born out the recession as consumerism waned, is well received by many.



Perhaps the most important force for widening horizons, redefining progress and changing perceptions of climate change has been the growth of global communications. **The proliferation of the internet has created a world more united than ever, but the cultural convergence has surprised many.** Instead of an influx of western, high-consumption ideals into the rural South, the principles of sustainable living and low-impact lifestyles are beamed into the communities of the West. This new technology has revolutionised perceptions: across the world every day people see, hear and begin to feel the global repercussions of unsustainable practices, a powerful force in reshaping definitions of progress and purpose. As a result, online and offline volunteering on projects has reached record levels.

resources

Resources are tight, but shrinking demand has lowered prices from their earlier peaks. Today's resources are increasingly measured and enjoyed in non-monetary measurements. Biodiversity and conservation initiatives are a shining example of redefining the inherent values of community assets.

National needs often take priority over business interests. For example, Brazil re-nationalised large sections of the Amazon after private companies failed to honour sustainability agreements.

Migration is on the rise, for two reasons: the experiences of climate stresses causes large movements; and 'quality of life' migrants increasingly seek fulfilment elsewhere. Successful countries appeal to citizens not just for safe sanctuary and jobs, but also because of higher levels of health and wellbeing. But for both these groups, the exodus is increasingly away from cities towards lower-density, rural area. In the global South, migrants are leaving urban areas in large numbers – an exodus that began during the recession – **desperate to seek 'the sanity of simpler lives'** elsewhere. Occasional conflict amid the rising demand for productive land emerges as a new challenge for authorities and communities.

politics

If it is people and their behaviour that have demanded today's Redefining Progress agenda, then it is governments and their laws that have delivered it. **Gross Domestic Product is no longer the litmus test of success.** Instead, laws, budgets and targets are littered with indicators of satisfaction and sustainability and countries compete to score highest in the World Bank's Wellbeing Index.

In the pioneering societies in the 2010s, governments with a 'mandate to simplify' were elected on manifestos that promised to uncomplicate lives. **The impact on business was sudden and ferocious** but received widespread public support. In one year alone, Holland imposed strict limits on the advertising of consumer goods; the EU reduced its Working Time Directive to 27.5 hours per week; and China announced that its Five-Year Plan would include an indicator of 'General Contentment and Wellbeing' for the first time.

In the UK the Department of Health is using social marketing techniques learnt in public health campaigns to roll out **tried and tested messages on 'contentment' and living within environmental means.** In Singapore, a radical new mayor is pioneering technology to scrutinise daily 'hot spot maps' showing suicide rates and prescriptions for anti-depressants to direct real-time responses.

Governments also legislate to directly shape new ways of living and support community resilience in the face of climate change. Generous grants are offered to encourage localised food, water and resource use, low-carbon transport strategies and small-scale renewable energy generation.

On the international stage, states have reached a new consensus to tackle climate change alongside focusing on trade, resource access and development. In international development, large-scale industrialisation programmes have been replaced with **small-scale, community-based ventures that promote education and health alongside job creation.** Much aid to developing countries is focused around the building up of resilience in the face of changing climate, and is exchanged for advice and training on traditional living within environmental limits.

impacts of climate change

During the 2010s, the global economic recession drove up oil prices, reduced emissions and forced energy efficiency and security upon struggling populations. As a result, emissions growth appears to have peaked and begun a steady decline.

But the impacts of climate change are still being felt as a result of earlier activities. In Australia, the economic recession coupled with drought has been particularly toxic; in coastal communities, cyclones batter communities and stretch their resilience to the limits. But strong levels of community cohesion help with adaptation to cope with the impacts of extreme events.

The greatest long-term impact has been from **the wider public awareness and the aspiration to 'slower' lifestyles**. While scientists report the outlook is brighter, leading thinkers still argue over whether today's 'beyond progress' agenda is enough in itself to guarantee real sustainability and a just society.

technology

Low-impact lifestyles have not resulted in the demise of demand for technology. Instead, innovations that help people lead less complicated and more fulfilling lives are booming.

But the pace of innovation is most definitely slower; the demand for incessant novelty has shrunk. **New product development instead focuses on durability, lengthening product life cycles and improving resource efficiency**. A mobile communications device that lasts for ten years has become very popular and 'rugged' gadgets that survive all conditions are selling well. Businesses and regulators scrutinise studies of the social and environmental impacts of existing and emerging technologies.

Energy generation comes from a patchwork of diverse, local solutions. While many of the decentralised and renewable systems were established during the depression, today the systems are expanding with locally devised solutions. Solar power has made major advances in Africa and the Middle East, wind power is experiencing an unprecedented boom in the US and in Europe biomass energy generation at a local scale is huge.

the role of the ICT sector

As the pace of innovation has slowed and demand for the latest technologies waned, ICT's boom days may look over. But within the sector, the most forward-thinking are capitalising on the new ways of thinking and living.

To meet the demand for low-impact living, ICT supplies detailed sensory networks, real-time analysis and inspired solutions to help citizens get 'more for less'. **People don't just want to monitor their fitness, diet, stress levels, knowledge and emotional health; they want systems that share their needs with their family, community and helpful businesses**. Today's personalised, real-time risk profiles, popular self-improvement plans and monitoring of community stocks and needs would not be possible without ICT.

ICT's ability to make information context-sensitive is critical. In Africa, information businesses are supporting rural education, health and job creation while demonstrating how this can fit in with traditional forms of living, language and organisation.

In addition, the demands for ever-higher levels of business accountability have developed a whole **new industry to measure social and environmental impacts**. Government and regulators assess detailed reports of a spectrum of businesses activities and their impact on people and places.

Finally, **people today also place particular value on community and family**. So ICT that connects the world's diverse people and places is flourishing. In China, **empathy engines**, allowing the instantaneous sharing of emotions between dispersed families and friends, is a lucrative market.



environmental war economy



4 environmental war economy

Tough measures have been adopted to combat climate change, pushing markets to the very limit of what they can deliver.

This is a world that woke up late to climate change. Efforts to broker a post-Kyoto agreement faltered, and instead, different regions of the world pursued their own priorities. But as the environmental impacts began to worsen, the world started to come together. In 2017 a global pact was signed, but even so, the global political community was forced into reactive strategies. Governments began to rely on hard policy to change how businesses worked and how people lived their lives. As time went on, the state adopted a stronger and stronger approach, rationalising whole

industry sectors to reduce their climate change impacts, and even putting 'Carbon Monitors' in people's homes to watch their energy use.

Governments now push markets to the very limit of what they can deliver. In different ways in different countries, economies have been forcibly re-orientated to focus on dealing with climate change, in much the same way as sometimes happens in times of war. But in most cases this has happened gradually, ratcheting up over time, with citizens surrendering control of their lives piecemeal rather than all at once, as trading regimes, international law, lifestyles and business have responded to the growing environmental crisis. And so in 2030, greenhouse gas emissions are beginning to decline, but the cost to individual liberty has been great.

a history of the world

2009	Surprise as the newly elected US president says climate change is 'B Priority'. German Chancellor Merkel cancels visit in response.
2010	A consortium of major global businesses representing 12 per cent of global GDP calls on governments to overcome their differences and support binding targets on greenhouse gas emission reductions.
2011	The post-Kyoto process finally breaks down as it becomes clear that only the EU seriously supports it. The EU perseveres with its internal cap-and-trade system.
2012	The IPCC's fifth assessment report is published, showing that the planet is on an accelerating trend towards dangerous climate change.
2013	The US sets up internal emissions trading.
2014	The US convenes top five carbon emitters (China, US, India, Russia, Japan) and agrees roll-out of its version of cap-and-trade.
2015	Bangkok is gridlocked for seven consecutive weeks.
2016	A new mobility regime is introduced in Guangzhou, China, restricting car ownership and use to essential services only. The high-profile launch is a resounding success and the model is replicated in other megacities in China and around the world.
2017	A new global treaty on climate change combines free trade agreements in return for global buy-in, especially from emerging economies.
2018	Reunification of Korea under the brokerage of Russia and China, with the capital in Pyongyang. International tax agreement harmonises corporate tax and outlaws offshoring. Antarctic Peninsula opened for mineral exploitation.



2019	Greenhouse gas emissions decline for the first time. Global climate change emergency fund established and is first used four years later to compensate Pakistan and India for receiving between them 14,000,000 refugees from Bangladesh.
2020	The year of no winter in the northern hemisphere. Ocean-seeding in the Andaman Sea to sequester atmospheric CO ₂ goes badly wrong, leading to famine and revolt in South-East Asia.
2021	FedEx pulls out of Latin America to avoid 'rationalisation'. The Economist publishes special supplement on the rise of 'state rationalism'.
2022	Oil price hits \$400/barrel. Greenhouse gas emissions grow again after three years of decline.
2023	The EU bans carbon-intensive imports and in return the African Union deploys trade sanctions.
2024	Voluntary euthanasia is legalised in India as a planned evacuation of coastal Bangladesh begins. Logistics sector (including FedEx) rationalised in US.
2025	Schism in Roman Catholic Church as Pope rescinds historic opposition to contraception.
2026	Greenhouse gas emissions begin to decline once more.
2027	Japan rewrites constitution as a 'corporate state'. Extreme heatwave in Europe kills 200,000. Governments suppress media coverage but news of the scale of the tragedy eventually gets out via the web. Scandal is muted as many believe publicity for severe climate events is bad for morale.
2028	Jean-Claude Bertillon, leader of the No Climate Change Party in Canada, is convicted of denying the existence of climate change. He is deported to the international convict settlement on Kerguelen in the Southern Ocean.
2029	First planned permanent settlement in Antarctica, a 'global community'. Projected 2040 population: 3.5 million.
2030	Environmental refugees from Bangladesh and Pacific Islands make up 4 per cent of the population of Japan and 18 per cent of the population of New Zealand.

business

Power lies firmly with the state, with a growing proportion of the planet's wealth channelled through the public sector. **Business is increasingly dependent on government contracts and successful companies have built strong relationships with governments to influence policy as much as possible.** In the 'Old West' of Europe, America and Japan, academics have observed the rise of the 'corporate state', in which big business and government collude and even set policy together. This has been formalised into the Japanese constitution.

With 'state rationalism' as dominant in 2030 as liberal democracy was in the late 1990s, the competitive environment for business has changed. **Companies and whole sectors are forcibly 'rationalised', where competition clearly doesn't benefit the public realm.** For example, in the logistics sector, despite individual operations being highly efficient, the overall distribution system was felt to have too much competition and spare capacity. As a result, the sector has been rationalised and transformed into a single private sector company in many countries. A similar restructuring has occurred with many supermarkets. Sectors that avoid such rationalisation are those in which a tax regime is used to directly drive efficiency, like in the energy sector.

Naturally, multinationals in particular have resisted rationalisation and fought hard to keep their autonomy, even closing operations in countries where rationalisation was threatened. **Small and medium sized companies have suffered as economies have restructured,** unable to pre-empt or influence state policy or achieve the same efficiencies as larger rivals.

The liberal critique of state rationalism argues that it **stifles the innovation that is essential for sustainable prosperity and combating climate change.** The World Economic Forum is the focus of a powerful emerging counter-culture. And in its new guise as a global pressure group, campaigns against the 'new global technocratic complex' and the concentration of power in too few hands.

economy

The late 2010s and early 2020s saw sustained economic growth as a global agreement on climate change secured open trade agreements between North and South, in return for binding emissions targets. This brought prosperity to new parts of the globe.

As a result, **the global economy today is less dominated by the big three of China, India and the US.** Instead, economic blocs such as the African Union, the Latin American Trade Council and the Alliance of Turkic States have emerged as powerful players on the scene.

This truly multipolar world performs against a backdrop of serious resource supply problems. The oil price has been rising steadily and in 2022 hit \$400/barrel. **Commodity prices are at unprecedented levels, leading to economic turbulence, stagnation of growth and uneven decreases in the volume of global trade.** Distance matters more, and regional and local trade is growing in significance.

The concept of the market is also in retreat. **Monetarism and liberal market democracies are old models, seen as unfit for purpose in a new world regime.** Although the market is the chief mechanism for generating value, states are far more powerful and collude with business to push the market as far as it will go to create climate-friendly outcomes.

Resource supplies are seriously tightening, and total resource productivity and carbon efficiency take priority over labour productivity. While tight regulation and firm direction from the state are resisted in some quarters, the pay-off is **high levels of employment.** International migration has been high for years, with countries of the South supplying labour for the economies of the North.



attitudes to climate change

Dealing with **climate change has become the number one priority**, and as sometimes happens in times of war, an extraordinary amount of resource is devoted to dealing with this one issue. It affects the lives of everybody everywhere on the planet.

A comprehensive agreement in 2017 created a feeling that the world was on track to deal with climate change. But this was replaced by frustration and anger as the effects of climate change were increasingly felt and as reductions in greenhouse gas emissions stalled. As a result, there is **widespread support among citizens for strong action from governments**, and a general willingness to participate in whatever initiatives the state deems necessary. State intervention is tough, but there is little widespread resistance as laws have been introduced incrementally over a decade in a way that most citizens perceived as acceptable.

Meanwhile, expensive, state-funded information campaigns reinforce the need for changes to lifestyles and aim to keep the mandate for state intervention strong. Inevitably parallels are drawn between this and the authoritarian state propaganda of the twentieth century. 'Climate crime' is a social faux pas everywhere, but **in some countries it is a crime to publicly question the existence of anthropogenic climate change** or to propose actions that could in some way contribute to climate change.

It is very rare to come across dissenting voices with any real power, but resistance to overly strong state intervention is occasionally violent. The media in some countries has been permitted to discuss whether the single focus on resolving climate change means that other equally important or inter-linked issues are being ignored.

resources

A world population of eight billion and increasing consumption per capita have combined to create **serious problems of resource availability**. Most commodity prices are at unprecedented levels, creating economic instability, bringing some speculators phenomenal profits (subject to heavy windfall taxes) and putting many manufacturers out of business. Investment in alternative materials, including nanotechnology-based materials, grows, as does expertise in extracting value from waste.

Oil prices are steadily on the rise. Even as some economies begin to wean themselves off oil dependence, demand grows as economies grow and consumption rises. Higher prices in the mid-2010s, followed by a concerted global effort on climate change, led to heavy exploitation of poor quality or previously uneconomical sources such as deep ocean oil fields and tar sands. Despite global opprobrium, **in 2018 the Antarctic Peninsula was opened for mineral exploitation**, including extraction of oil. Although the oil fields were closed down just six years later, other mineral extraction continues apace.

The oil price broke \$400/barrel in 2022. Such costs meant that shipping and aviation, still largely oil-dependent, became prohibitively expensive. New fuels and transport modes are coming on-line in 2030 but international trade is still more difficult than it used to be.

Population growth and the legacy of the 2000s biofuels boom mean that **land is at a premium for agriculture and for settlement**. This is exacerbated by the effects of climate change. Bilateral agreements on immigration have been signed. For example, Canada has agreed to receive 800,000 environmental refugees from Mexico and Central America.

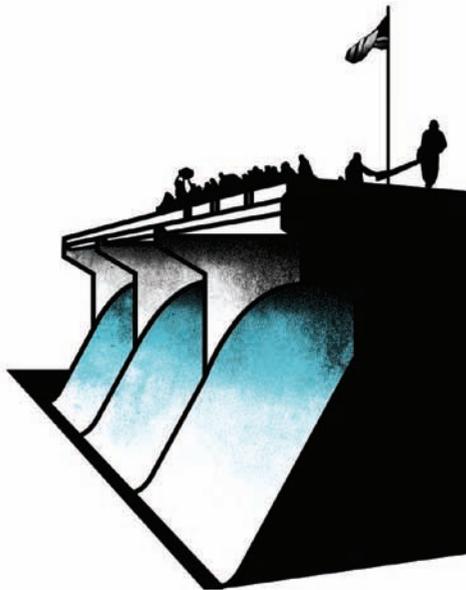
New lands have been opened up for settlement. **International convict settlements have been established** on Kerguelen, South Georgia and New Zealand's South Island. Planned permanent settlement of the Antarctic Peninsula began in 2029, taking people from climate-stressed countries. Styled as the first true global community, its population is projected to be 3.5 million by 2040.

politics

The 'state rationalism' model dominates the world, with **many countries on the equivalent of a war footing to deal with climate change**. The model first began to emerge in the cities of China, where strict measures were taken to combat gridlock such as restrictions on car ownership and curfews for non-essential travel. Countries still look to the East for leadership on this statist approach.

The model has been adopted in very different forms around the world. Some states allow a greater degree of freedom for their citizens and devote more resources to adapting to the impacts of climate change than reducing greenhouse gas emissions. Where this has led to increases in emissions, such states have become international pariahs. Other governments have found it more difficult to bring the populace with them on stringent measures, and have met resistance.

Despite a faltering economy and reductions in trade, **global collaboration is still strong**. The 2017 climate change consensus is still in place and in particular the agreement on the movement of refugees is working effectively. For example, **environmental refugees make up between three and four per cent of the populations of Italy and Japan and 18 per cent in New Zealand**. But concern about the emergence of rival economic blocs is rising. The European and African Unions are continually at loggerheads over the question of carbon quota imports.



State-led economic rationalisation puts enormous strain on the public purse. **Levels of taxation have increased and some countries run a system of climate bonds**, sold to investors to provide funds to intervene in the economy.

Government intervention in public life is at a level not seen since the mid-twentieth century. This typically takes various forms:

- subsidies, such as those for food production or solar energy
- rationing, with certain governments allocating per capita resource quotas and taxing consumption above that, banning personal car ownership or forced replacement of convector ovens by microwave devices
- imposed social programmes such as social clubs and compulsory youth groups
- commissioning giant public works – the big energy projects, adaptation measures and resettlement programmes
- banning of 'climate crimes'.

In some countries **a licence is now required to have children** and these are awarded according to a points system. Climate-friendly behaviour means points.

Public monitoring is commonplace. It is not unusual for governments to monitor household energy consumption in real time, with warnings sent to homes that exceed their quotas. For example, citizens could be told to turn off certain appliances such as washing machines or kettles or even have them switched off remotely.

impacts of climate change

Climate change has been faster and more severe than anticipated in the IPCC's fourth Assessment Report in 2007. In 2020 temperatures in the Northern Hemisphere did not drop as normal during the winter and in some countries spring began in early December. In 2027 an extreme heat wave killed hundreds of thousands in Europe. The fifth Assessment Report in 2012 gave the world little hope of avoiding 'dangerous climate change' but had a galvanising effect on global efforts, which until then had been led by the EU and US.

Hope bloomed in 2019 when greenhouse gas emissions appeared to decline for the first time, but this was soon offset by economic growth in the developing world. They began declining again in the late 2020s as a result of highly interventionist policies by governments across the world, but by this stage **scientists were anticipating radical and unavoidable changes.**

technology

Technology **research and development is being directed primarily at climate change.** There is a high level of global collaboration to this end, among businesses as well as governments.

There has been significant global investment in centralised nuclear power generation and 'clean coal'. In 2023, the last of China's coal-fired power stations was fitted with carbon capture technology. **Carbon sequestration is a commonplace and trusted technique** despite accidents in the early 2010s.

There have also been multiple experiments with geo-engineering, but as yet none has been successful enough to replicate at a global scale. In fact, some have been disastrous, for example an attempt to capture atmospheric CO₂ by ocean seeding in the Andaman Sea led to local devastation and the collapse of the fishery, in turn causing localised famine in coastal Burma, Thailand and Bangladesh.

Decentralised energy systems, with households, offices and communities generating their own energy, proliferated in the 2010s, especially in the new emerging economies of Africa. **Energy efficiency has been a very effective means of reducing greenhouse gas-intensity and has been relatively easy to achieve in the 'rational state' system.**

Vast sums of money are being invested in **nanotechnology research** in the hope that efficient nano-solar power generation and new, lightweight materials that are cheap to manufacture can be developed.

The singular focus on technology for climate change has created a debate in some media that **generalised innovation is being stifled**, and the chances of research stumbling upon new and surprising solutions has been reduced.



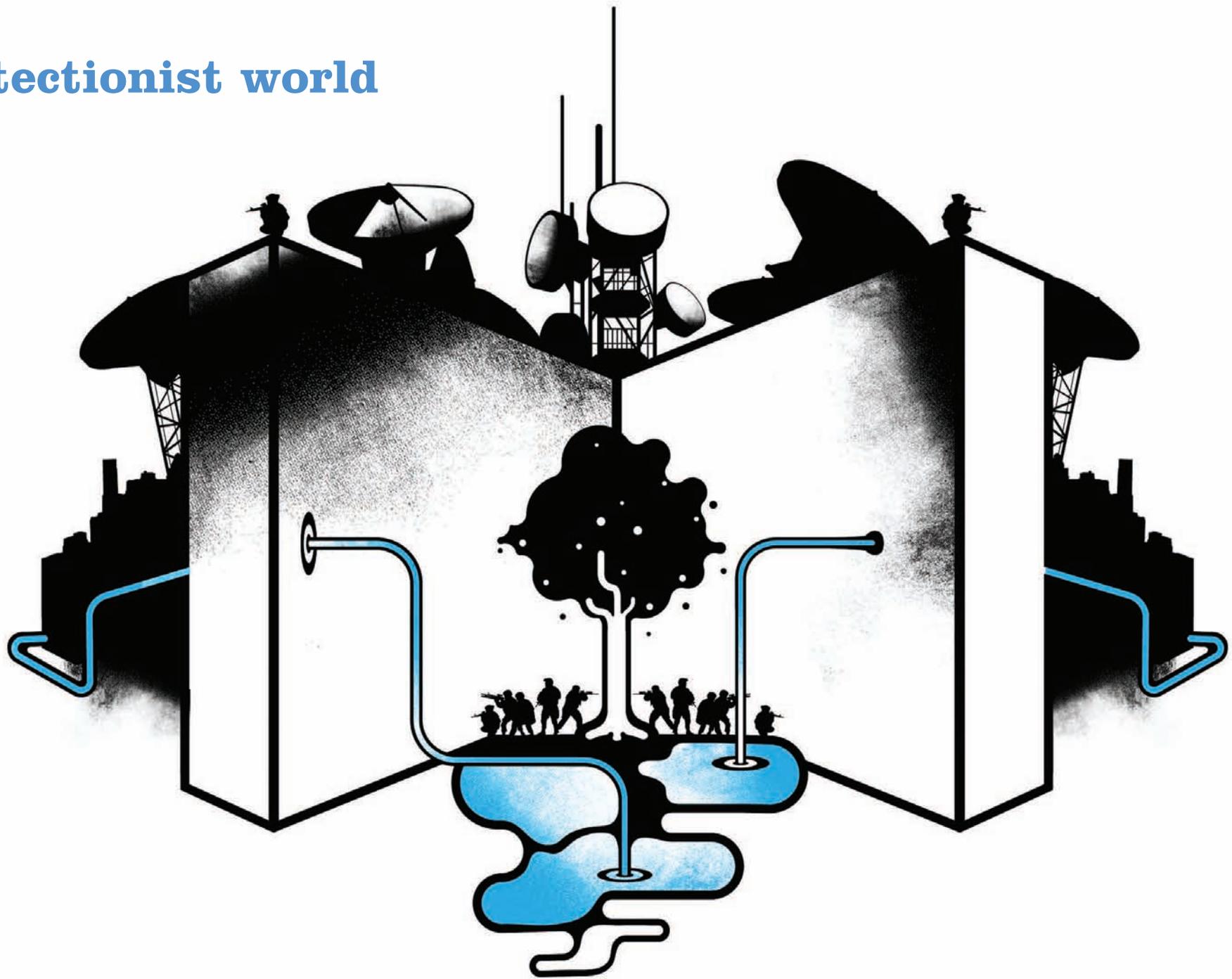
the role of the ICT sector

ICT has a central role to play in enabling state rationalism and ensuring that it is effective in combating climate change. It is employed widely to create efficiencies in systems and policy frameworks to ensure that savings are not offset elsewhere by increases in consumption. Much infrastructure is being re-engineered with ICT at its heart and the rationalisation of business relies on it. **ICT is also an important way of enabling communication, exchange and trade to continue, in a world where physical transport is severely restricted.**

Meanwhile, the types of technology that the ICT sector can manufacture are subject to strict laws. All technology must conform to demanding standards on energy and materials use, and **must always supply its own energy through capture of ambient sources or otherwise.** All components and mineral ingredients must be fully recoverable and all products must be guaranteed as long-lasting. **The state has mandated access to companies' product road maps on a confidential basis,** to ensure that technological effort is properly directed and not duplicated by different companies.



protectionist world



5 protectionist world

Globalisation has gone into retreat and countries focus on security and access to resources at any cost.

Globalisation has entered a phase of historic retreat in this divided world. Despite the Climate Agreement of 2012, accusations of 'cheating' in the carbon markets and 'secret', undeclared power stations collapsed cooperation into factions. A poorly coordinated response to climate change combined with violent resource wars has fractured the world into protectionist blocs.

Climate change acts as a 'risk magnifier' – adding to the strains of communities unprepared for its impacts. The resulting competition and conflict drives up prices, discourages trade, hampers long-term planning and spreads diseases that mean hunger and misery for millions. Mitigating further climate change is all but

abandoned as the pressing needs of the current reality are prioritised.

Governments focus on securing supplies – hoarding assets, curbing exports, and protecting their own economies through high import tariffs. Violent factions and cyber-terrorists capitalise on the chaos to promote and fund their nationalist causes – scrambling for resources, paralysing communication networks, and launching occasional, but devastating, bio-chemical attacks.

Communications like the 'world wide internet' have fragmented. A small group of academics preserve a global network; their dream to 're-unite' the world. Yet the experience for many today is one of financial hardship and empty markets, rising nationalism and social unrest, restrictive security, and sustained conflict over precious supplies.

a history of the world

2009	New US president vows to make tackling climate change a top priority.
2010	The Chinese government agrees to join an international climate change agreement.
2011	US authorities express concern after a series of high-profile takeovers of American firms by Middle and Far Eastern investors, believed to be linked to 'unfriendly governments'.
2012	After exhausting negotiations, a new global agreement to tackle climate change is signed to great fanfare and optimism.
2013	A series of high-profile terrorist attacks in the US and Europe result in a rush of new security measures. Four countries fail to make legislative time to ratify the new climate agreement.
2014	Massive fraud uncovered in one carbon trading authority.
2015	American pharmaceutical share prices receive an unexpected boost after a major health scare over products manufactured in the Far East.
2016	Unidentified terrorists sabotage critical cables under the Mediterranean that link the Middle East and South Asia to the World Wide Web. Quarrelsome negotiations over who will repair the cable are drawn out. China quietly welcomes the split, blocks access to the international web and begins investment in a rival; the US and Europe welcome the move and claim to be experiencing a decline in international cyber-crime and cyber-espionage.





2017	Five years after a global agreement was signed, an attempt to integrate parts of Asia into a new global emissions trading scheme are abandoned after US accuses China of 'systematic lying and cheating' during the talks. The British government publishes a dossier detailing China's 'Human Rights and Carbon Violations' alongside satellite images apparently showing undeclared and secret coal-fired power stations.
2018	Russia announces measures to burn supplies of methane to mitigate climate change, a move condemned by leading scientists who predict the release of 'catastrophic levels of CO ₂ emissions'. Great Ebola epidemic causes widespread panic and kills over 100,000 across Africa. World Health Organisation officials barred from two countries, hampering quick diagnosis.
2019	Tensions between militant forces in India and Pakistan reach boiling point as factions from Iran, Afghanistan, China and Russia are all drawn into the conflict.
2020	AsiaNet registers its one billionth user and proves itself a faster, cheaper, more reliable and linguistically convenient alternative to the 'American web'.
2021	Intense stresses over water supplies across Middle East and Africa result in severe drought. China offers to mediate over the conflicts. Rising nationalism in Canada results in Alberta and British Columbia following Quebec's earlier lead and seceding.
2022	International NGOs and the far-right Front National condemn an agreement between the French and Algerian Governments to exchange ten years of nuclear waste for a one-off shipment of 80,000 environmental refugees.
2023	India accuses China of an 'act of war-like provocation' over its alleged diversion of the Brahmaputra River. Pakistani militias attack Indian-controlled Kashmir with bio-chemical weapons and India turns down an offer of peacekeeping troops from Iraq.
2024	South Africa voices strong opposition to the invitation to Morocco to join the EU in exchange for exclusive access to solar energy supplies for Member States through to 2050. The African Union looks set to disintegrate as Libya and Algeria join Spain and Italy in a Mediterranean 'lower tariff' trade agreement.
2025	Bangladesh experiences unprecedented and severe flooding, resulting in the displacement of hundreds of millions. As India closes its border, China steps in to offer new protective technologies and humanitarian support. The Chinese troops sent to assist form a permanent base in the country on the border with India.
2026	The new Islamic government in Egypt bans all ships from the Suez canal except those from 'friendly states'. The government is overthrown in a 'popular revolt' orchestrated by British and French Special Forces.
2027	The UK, France and Switzerland jointly condemn a move by a Japanese pharmaceutical firm to buy part of the Amazon rainforest from the Brazilian government.

2028	The US announces a new tax on the importation of goods manufactured in the Far East 'to protect the American people from hazardous goods and dangerous nations'. China responds by declaring that it will levy a 90 per cent corporation tax on all American companies trading in China. Negotiations begin to establish the 'Freedom Trade Association' between China, Vietnam, Burma and North Korea.
2029	Coca Cola reveals that its distribution network is shrinking for the first time in 135 years. The company details plans to close some of its overseas offices, culminating in the fateful 'America First' marketing strategy of the 2020s (called 'Hispanicos Primeros' in Latin America). The company later splits into two rival companies each claiming to be the 'sole protectors' of the original recipe.
2030	The US president launches a re-election campaign with a populist speech entitled 'What is the Point of the UN?' after a debate in New York descends into factional chaos. Francesca Tupiana's 'The End of Globalisation' becomes an international bestseller.

business

The average distance that people and goods travel today is shrinking for the first time in modern history. Destructive wars, costly travel, unreliable communications, sustained economic recession, transnational crime, sporadic epidemics, bureaucratic borders, and perpetual terrorism severely hamper commerce.

Tit-for-tat protectionism is damaging international businesses. Restrictions frequently appear more political than economic. Punitive tariffs and quotas block access to new markets, while curbs on the export of food and energy create critical shortages in supply chains.

Some countries even ban certain foreign goods. **Corporate takeovers by foreign investors are tightly regulated**, and investors from the Middle East and China find it increasingly difficult to hold any significant stakes in key western industries.

Meanwhile, criminals and terrorists disrupt supply chains, compete in traditional markets and systematically replicate ideas, products and services with no regard for copyright laws or intellectual property rights. Some audacious gangs even start levying 'taxes' in European cities in return for protection from physical attack. Across many borders, businesses rely on private armies for protection. Smuggling or **'neo-piracy' is a lucrative trade** and the threat of extortion or kidnap is a constant fear for corporations.

Yet by far the greatest threat to business comes from vulnerabilities in communication networks. **Cyber-terrorists routinely target key infrastructures remotely**, breaking through firewalls and coordinating attacks from safe havens in collapsed states. A series of massive data thefts has bankrupted two multinationals. The identity remains unknown of those who caused the recent e-security breach at one American energy depot, resulting in system overload and a remote detonation.

economy

Globalisation is in retreat as supply chains, workforces, markets and even the internet have begun to regionalise. Trade focuses on regions, tightly constrained by geography and political allegiance. **China no longer exports cheap manufactured goods en masse to the West**. Instead, its demanding middle class is supplied by manufacturing 'sweatshops' outsourced to Africa and nearby political and trade allies.

Bilateral trade agreements have succeeded global ones, but the replacements are often cultural or politically determined. A very reduced 'British' Commonwealth is a thriving curiosity, and stands out as one of the most internationalist of forums for trade and diplomacy.

Cultural fragmentation accentuates religious and ethnic distinctions, uniting peoples into competing factions. Power blocs and their proxies conflict over trade





routes and scarce, valuable resources. 'Water wars' are a defining feature of the decade for Africa and the Middle East.

Today, **AsiaNet is firmly established as a faster, cheaper, more reliable and linguistically convenient alternative to the 'American Web'**. Many national governments block access to different internets with complex firewalls, but many use 'network havens' offered by rival nations to circumvent controls and access previously restricted areas.

attitudes to climate change

Climate change is understood, experienced and severe – but the collective will to tackle global problems evaporated after the agreement reached in 2012 broke down. **Populations around the world are united only by their fear of the future**, and frustration at the relentless violence over sparse resources.

The lack of preparedness for climatic events forces populations to turn inwards – to tackle food shortages, cope with the unexpected and extreme weather, and survive in conflict. **Adaptation is prioritised above all else** with hastily constructed sea defences, ambitious national irrigation schemes, and emergency responses to repeated crises.

Long-term planning for climate change receives only localised and sporadic attention. The benefits of cooperation never appear to outweigh deeply held suspicions and the threat of conflict.

resources

Scarce resources – particularly energy, water, food and fertile land – are the subject of intense competition that frequently erupts into violence. The Middle East and Africa face particular tensions over fresh water supplies, and the **bio-chemical warfare that erupts is particularly devastating**.

The protection of dwindling resources is prioritised – armed guards supervise wheat and rice shipments in the Mediterranean, private militias protect lucrative rainforest supplies in Latin America, and the **soldiers of nations and businesses fight to mine new sources of oil, gas and gold in the melting North-West passage**.

New diseases and pandemics – propelled by the warmer world – force the closure of borders to visitors and migrants, and result in aggressive accusations over where responsibility lies for tackling the outbreaks and refugees.

Governments prioritise self-sufficiency in energy, water and food supplies. Energy efficiency is a national priority, while many countries with their own fossil fuel supplies burn them, ignoring the warnings of experts. The largest land massed nations – like India and China – focus on developing resilient supplies of key resources under national control. As a sign of the times, some regions today have begun **quoting a 'local price'** for resources such as oil.

politics

International trust is at its lowest level for over half a century as nationalism, protectionism and resource conflict dominate the agendas of parliamentarians and diplomats.

States increasingly focus on the management of up-stream partnerships to guarantee access to key resources such as rivers and food supplies. Where these **agreements break down, ecosystems collapse and famine is common**.

The growing **neo-imperial powers of Brazil, South Africa, Russia and China** increasingly flex their muscles and create a patchwork of overlapping influence and 'satellite states'. International aid has shrunk, but survives in pockets of bilateral support, tightly focused on rewarding cooperative states with resources, technology and military hardware.

impacts of climate change

The severe impacts of climate change exert a heavy toll because communities are underprepared. But it is the potency of environmental changes to aggravate geopolitical and social concerns that is most worrying.

In many rural areas, unpredictable rainfall patterns, heat waves and droughts lead to repeated crop failures. Uncontrollable logging and improvised resource extraction aggravate ecosystem collapse. On the coast, floods, hurricanes and typhoons batter unprepared communities. Diseases like typhoid fever compound the devastation, while new malarial outbreaks in corners of Europe cause panic.

The sporadic but **massive flows of refugees – exacerbated by the absence of any international cooperation – provoke a simmering discontent in cities** already unsettled by food rioting. As resource and energy shortages starve the economy, more and more governments look at risk of collapse.

The outlook for the global climate is bleak. Many countries have dramatically increased emissions, primarily through the intense plundering of coal resources. Scientists report that future impacts will be much graver than earlier forecast due to a complete lack of any sustained effort to cooperate on mitigation. Where they are attempted, **long-term responses are sporadic and unilateral**. The US is one of the only countries seriously exploring geo-engineering on the scale that would make a difference to the climate.

Long-term mitigation is abandoned in favour of the immediate needs of adaptation. Yet many countries cannot afford effective technologies, and the collapse of the Adaptation Fund Agreement that would have shared resources, technology and much-needed cash, means that the impacts in the poorest developing countries are particularly severe.

These communities are left to focus on short-term reaction. The next major flood or drought is met with a highly politicised, unpredictable and sporadic response, leaving millions at the mercy of the elements.

technology

A high level of investment in research and development is a priority for both business and government in this highly competitive world. But **different technologies succeed in different global regions** and the global market for high-tech goods has shrunk.

Today's most lucrative innovations deliver resource replacement, adaptation to a changing climate and military protection. **Laboratory creations of artificial substitutes for mined materials in unstable locations are the subject of intense research.** And new properties are added to existing materials using nano-technologies.

However, copyright laws are routinely flouted across the globe. A recent EU Committee strongly condemned two 'pariah states' for sanctioning the deliberate replication of key technologies from EU members.

Energy development is as much government policy as a commercial concern and is frequently caught up in diplomatic and military wrangling. Countries that acted early to localise energy supplies and invest in renewables find themselves well prepared for this divided world.

what is the role of the ICT sector?

On the one hand, ICT is hindered with globalisation in retreat. Connecting people and places worldwide is less desirable or feasible than it was 20 years ago. Business is tough: **sourcing raw materials is difficult and costly and the black market of imitation goods provides a real threat** to large firms. In addition, unreliable and expensive energy, frequent blackouts and economic unpredictability mean that short product life cycles and fast-paced innovation are impractical.

In manufacturing, focusing on recycling and closed loop cycles is one way to offset the spiralling costs of resources. Second-hand, refurbished IT equipment forms a popular, high-value business opportunity.

Both consumers and business markets **prioritise rugged durability and energy efficiency** in their ICT. Marketing strategies emphasise the resilience of offerings and how long they will last. Technologies that can store surplus energy, and so flatten the demand profile, are also valuable.

Security technologies are particularly successful. Governments and businesses seek new ways of remotely measuring and tracking citizens, supply chains and competitors. ICT users also demand robust protection from online and offline attacks. Both formal companies and informal operators in the ICT community are constantly seeking innovative ways to provide protection from the latest threats, as well as a means of undermining established security in today's divided world.



implications – ‘the climate change years’

When we think of the 1930s we think of the Great Depression and histories of the mid-twentieth century are dominated by the Cold War. Historians of the future are likely to call the decades to come ‘the Climate Change Years’.

The Cold War, as well as being an important issue in itself, cut across practically every other global issue, from trade and industry to sport and space exploration. Climate change is likely to be similar, dominating agendas in itself, and a factor influencing decisions right across the board. The direct impacts of climate change – and attempts to mitigate and adapt to climate change – will form the subtext and backdrop to geopolitics. Anyone reading between the lines will find ‘climate change’.

The five scenarios developed through the *Climate Futures* process outline different ways that humanity might respond to climate change – different social attitudes, economic frameworks and governmental policies. The ‘real’ future is unlikely to mirror one of these scenarios closely, but it could well incorporate different aspects of the different scenarios, at different times and in different places.

The scenarios are designed to stimulate ideas and challenge how organisations think about the future. They can be used as tools in creative or collaborative processes, for coming up with new strategies or ideas for products and services. We hope they will be used in this way, and lead to more prepared organisations, ready to face the ‘climate change years’, and equipped to steer the world in a positive direction. We explain how organisations can use them in the appendix, ‘Using *Climate Futures* scenarios’.

Organisations will no doubt respond to the scenarios in different ways. But below is our response: five broad implications, derived from what some or all of the scenarios share in common, or based on insights throughout the process of building the scenarios.

For each implication, we also set out how business in particular could act now.



1. prepare for a radically different future

We know that change is coming. The world could move quickly to combat climate change, with market frameworks being recast and the operating context for business altering radically, based in part on progressive policy.

Or things could move more slowly, and if that happens the world may soon be staring over the sort of 'Climate Cliff' that eventually galvanises action in our Service Transformation scenario – we may well be forced into more reactive responses.

Whatever happens, business as usual is not an option. Cost and availability of energy, customer expectations, state intervention and geopolitical shifts all feature in our scenarios as potential disruptors of existing business models. Every aspect of a business will be affected one way or another – the demand from customers, how goods or services are produced, the supply chain, the nature of competitive advantage; the way staff live their lives, and the regulatory context for business. No business is immune from the climate change years, no matter how small or low-carbon they are.

It looks inevitable that, at some point soon, there will be a revolution in business on a scale to dwarf the current cleantech boom or the dotcom boom of the late nineties.

what it means for business

Be open to the future. Thinking through scenarios such as the *Climate Futures* scenarios will help businesses to rehearse different strategies. Conversations about future strategies might not lead anywhere in the short-term, but the simple act of having them could open minds to the possibility of rapid change.

Don't bet on one version of the future. There are five different scenarios in *Climate Futures*, and although some might seem more likely than others, none is

impossible. We know that the response to climate change will require a combination of technological innovation, social and economic restructuring, behaviour change and so on, but we don't yet know the mix. Approaches are also likely to differ across the world. Long-term strategies must acknowledge uncertainty and build in adaptability, or risk failure.

Prepare now. In many of our scenarios, change comes quickly and unexpectedly. Tipping points in the climate or in the social and economic context could catch unprepared businesses off guard. If organisations wait for the crisis to intensify, and change happens very quickly, then the sustainability of the business will be under threat. Preparing now means:

- assessing existing business models for vulnerabilities to the disruptions that climate change might bring, and taking steps to minimise these;
- understanding where new expertise will be needed. Architects and insurance companies will need climate science to understand the future environment in which their products will operate. Consumer electronics companies will need energy policy expertise to understand how power supplies might be affected;
- putting a climate change mitigation programme in place. Take 'no regrets' actions now, and understand the impact of the whole product/service lifecycle, even parts that fall outside of the immediate sphere of influence. This will allow possible future vulnerabilities to be identified early, and also develop expertise within the organisation to cope with future expectations from customers and governments. The cost of implementing a climate policy rapidly in reaction to external demand is likely to be much greater than proactive step-by-step building; and
- developing a greater understanding of the social context in which innovations are deployed. In some of the *Climate Futures* scenarios, businesses are required to take responsibility for the wider impacts of their products and services.



2. the opportunity for leadership

Time and again when we were constructing the scenarios, we discussed how a specific sector such as business or government could act, but only if other sectors let them. Addressing climate change is a collective action problem: no part of society can act alone, but if we wait for everyone else to act then we will never get started.

Nevertheless, there is the opportunity for companies, countries and consumers to lead. First movers may get some advantage from 'no regrets' actions, and at the same time create the space for others to act. For example, as it is currently expressed, ethical consumerism is limited in its direct impacts. But it does signal desire, which companies and governments can use to try out new systems, products or processes that can then be rolled out more widely.

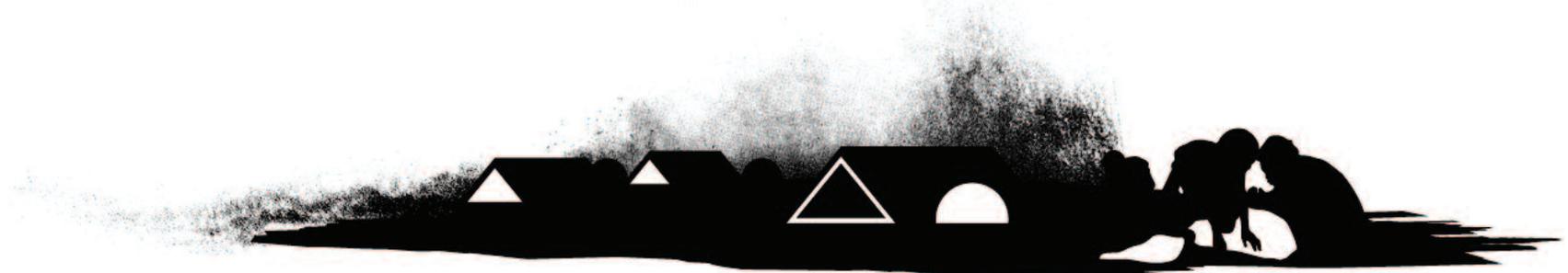
Countries and regions can benefit from leadership. California has combined environmental standards with high growth. Indeed, the environmental standards have promoted innovation and put Californian businesses in prime position for taking technologies and techniques around the world. The opportunity for countries, companies and citizens is to lead in a way that makes it easier for others to follow, and for themselves to benefit from others following, creating a virtuous circle.

what it means for business

Look for leadership opportunities that give immediate returns. There are immediate cost savings to be made from energy efficiency measures, and low-energy companies are less exposed to price hikes or energy legislation in the future. Likewise, leading the supply chain on energy efficiency can spread the benefits globally and change distant economies quicker than international negotiations, as well as save money.

Acknowledge the long-term benefits. Society needs businesses that are meeting social needs and generating wealth. Businesses need a society that is stable and prosperous. The long-term interests of business and society align with creating a strong, resilient, low-carbon economy. The expectation that businesses will take a leading role will grow. There are multiple long-term benefits for businesses adopting a leading position now. For example, lobbying governments on climate change policy may lead to regulation that is more business-friendly. And being perceived as a leader in climate change could lead to greater influence and better access to governments, as well as a better brand image.

Talk to investors about climate change. Institutional shareholders hold substantial power in the business world, and have a vested interest in an economy which is stable and prosperous in the long-term. Some of our scenarios, particularly Protectionist World, are clearly not in their interests. For this reason, it is likely that institutional shareholders will place increasing emphasis on corporate policy that encourages long-term prosperity – keeping the pie large, rather than fighting for larger shares of a shrinking pie. Businesses that engage with this concept and play a proactive leadership role will be at an advantage.



3. technology delivers solutions, when in the right system

All our scenarios feature innovations, but are not driven by the new technologies. Why not? Because just inventing is not enough. To be successful, a technology must work in tandem with the systems within which it will operate – behaviours, skill sets, economic incentives, alternatives and so on.

There are many technologies that are financially viable and reduce emissions but have never taken off. It is not enough to wait for technology to fall, like manna from heaven. We need to create a system where the right technologies are adopted. The critical question is: can we create an economic policy framework in which the low-carbon economy grows a lot faster than the high carbon economy? Even with the different paths, our scenarios have some common technologies:

- **renewable energy sources** are present in all. There is likely to be a step-change in investment in research in this area, which will pay dividends certainly before 2030. In particular, decentralised solar power can help the global South leapfrog to energy generation without building a grid infrastructure;
- **technologies that save energy** will prosper. This is the focus of Efficiency First's reframed markets but is just as important in Environmental War Economy and Protectionist World, where access to energy supplies is restricted;
- **carbon capture and storage (CCS)** is hard to avoid. CCS may take 10 years to be commercially viable on a large scale, but it combines addressing climate change with increasing energy security and with a proven energy source – coal – that will almost certainly remain a major part of the energy mix to 2030;
- **ICT** performed a critical role in every scenario: from 'smart' management of demand and supply in energy grids or transport systems, or the remote monitoring and efficiency control of Environmental War Economy, to the services aggregation of Service Transformation, the empathy engines of Redefining

Progress, or the smart software used in policy-making in Efficiency First. Despite the possibility of a Protectionist World-type retreat of globalisation and fragmentation of the internet, ICT looks here to stay.

However, in our scenarios geo-engineering didn't feature as an ultimate solution. Instead, it was used chiefly to buy more time as some critical threshold was approached. And where there was greater reliance on geo-engineering – particularly in Efficiency First – there was also greater disagreement about what the end-goal for such direct intervention in the climate system should be.

what it means for business

Plan to exit from high carbon technology. At some point in the future, technology that directly or indirectly emits a lot of greenhouse gases will become commercially unviable. Identify what high carbon technology the business is committed to, and develop plans for alternatives at the earliest opportunity, minimising emissions during the transition with efficiency measures.

Explore opportunities for low-carbon technology. Many of the commercial opportunities related to the climate change years are based on the development of new, low-carbon technologies. There will be a myriad of opportunities to invest in these. Supporting innovation in this area and monitoring new low-carbon technology as it emerges will position businesses well for the future.

Explore different drivers for technology development. Consumer demand is no longer likely to be adequate justification for technological innovation. In Service Transformation, Redefining Progress and Environmental War Economy, governments are concerned with the impact of technology on the overall system and attempt to influence this, either through market-based incentives or more direct legislation. Technological solutions that are designed to address climate change will need to be deployed alongside social and economic policies that ensure their effective uptake. Successful innovators will no longer be able to rely only on a combination of engineers and market analysts. Psychologists, sociologists and ethnographers able to analyse the impact of a potential innovation on society will become increasingly important in corporate research and development.



4. grounds for hope: the paths to a better 2030

Many of the interviews we conducted with experts from around the world followed a similar argument: there are many, many options for dealing with climate change, but serious efforts to explore them are woefully thin on the ground. In fact, many people told us that the current response is trivial given the scale and urgency of the challenge. This led in many cases to apocalyptic fatalism.

But in the scenario development process, we considered how steps taken now could open up previously impossible or unimagined paths of hope for combating climate change. And although none of our scenarios is a perfect world, in four out of five climate change is being dealt with in one way or another.

The paths to a better 2030 that we explored often required some sort of climate change-related crisis to galvanise action, for example a catastrophic event in a developed country. But relying on disaster to avert further disaster is a dangerous strategy. Waiting for a catastrophe means more cumulative emissions and the risk that the event is itself the result of runaway climate change. And a panicked response to a catastrophe might address climate change, but at a high price.

We need some sort of proxy for catastrophe that will have the same galvanising effect but not endanger lives. Accepting that the high-impact event with no loss of life of which Jonathon Porritt talks (see page 13) is unlikely, we will need to talk about climate change, understand and disseminate the science, and most importantly understand how people are already affected by climate change, as much as possible.



what it means for business

Don't be paralysed by the scale of the challenge. Major change is necessary, but if that looks impossible, small steps could open up entirely new paths down which radical action is more likely. Taking a step back now to rethink the assumptions underlying current business models could not only make a vital contribution to sustainable development, but also be essential for ensuring long-term business success.

Help create a more positive future. The majority of the experts we spoke to in the research for *Climate Futures* saw the business response as vital in shaping the sort of future we can expect. More than merely observing events and responding to them, businesses can help to create a more positive future, and help avoid the less palatable elements of our scenarios. This could mean:

- identifying new business opportunities where core competencies can be used. As the business landscape changes in response to climate change, new opportunities will emerge that allow companies to profit from making society more sustainable. Those companies that have invested upfront in exploring those opportunities will prosper;
- identifying where the existing system places barriers to the company being more sustainable – such as market failures and perverse incentives – and lobbying for change;
- developing partnerships between the private, public and voluntary sectors. These are likely to become increasingly important in finding solutions. Think of NGOs as potential allies and critical friends rather than enemies;
- engaging with institutional shareholders on sustainability issues.

Talk publicly about the importance of climate change. Businesses can do themselves, and society, a service by using their marketing insights to galvanise action.

5. three reasons to support a global agreement now

There are many reasons why it's important to reach an inclusive, global agreement to address climate change as soon as possible. The *Climate Futures* scenarios strongly illustrate three reasons in particular.

Acting quickly is best for liberal markets. Some of the strongest objections to addressing climate change have been that we will constrain markets, and hence our freedom, at too high a cost. People have feared that climate change was a cover for rolling back the market reforms of the last decades. But in our scenarios, liberal market-based solutions seem much less attractive as time goes on than statist responses. This puts a different light on how to defend freedoms from market reforms. Advocates of liberal markets should act as soon as possible, pushing for a global agreement with teeth, national measures that use financial incentives, and the removal of market distortions that encourage unsustainable and wasteful resource use. The result may be a more constrained market system than today, but the long-term alternative could be a desperate turn to big government and protectionism.

Acting quickly avoids a vicious circle. The march of globalisation has seemed inevitable for a generation, but the impacts and responses to climate change could well put it into retreat. This happens in Protectionist World and for a time in Environmental War Economy. It is very likely that addressing climate change will need effective global institutions that can create and enforce international agreements. It will also need the trading and cultural links between nations to be maintained, so that we can act together. But there are already stresses in global systems that climate change could take to breaking point. For example, in 2008 we have seen a former US Treasury secretary saying that the proceeds of globalisation need to be shared better, trade barriers have been placed on food in different locations worldwide, the French president has threatened tariffs for carbon intensive imports and the Doha trade round is still in limbo.

The very global institutions needed to address climate change are also threatened by it. We need to act now if we want to avoid descending into a vicious circle, in which our ability to cope with a mounting problem is systematically undermined.

Acting quickly means going with the grain of other policy. Climate change is the sort of problem that cannot be addressed in isolation. Droughts and water shortages, famines and food price hikes, refugees and mass migration, poverty and inequality, are all problems with their own set of driving factors. But climate change could exacerbate and be exacerbated by all of them, creating the potential for global instability of unprecedented proportions.

If climate change policy comes into conflict with another policy, for example to alleviate poverty, then the effectiveness of both is likely to suffer. Wherever possible, efforts should be made – in businesses as well as in governments – to promote policies that work with the grain of other priorities rather than against. This is another way of saying that environmental policies will work best if they are also social policies and economic policies. This goes to the heart of what sustainable development is all about.

The longer we wait to tackle climate change, the bigger the problem gets and the more likely it is that climate change policy will work against the grain of other policy.

what it means for business

Support changes to markets now. The scope for freedom of action in response to climate change narrows markedly over time. To avoid tight regulatory frameworks and severe restrictions on freedom of action, businesses should do what is possible now to support early and progressive policy on climate change, even if it increases the regulatory burden. Businesses that resist regulation now on climate change-related legislation are making a rod for their own backs.

Support the 'right kind' of globalisation. There are many well-rehearsed and often justified arguments against globalisation. But the problem is not globalisation itself, rather it is certain aspects of how global trade and political relationships are



conducted. A global ethic and dialogue through trade are essential if we are to address climate change effectively – it is after all a global problem.

Companies should do what is possible to support global institutions, open and equitable trade and cultural exchange. Multinational companies can foster links across the world to combat climate change, for example helping to share best practice in low-carbon living between different countries, as happens in our scenario Redefining Progress, or by finding ways to share the proceeds of growth within and between countries. Companies in the ICT sector in particular, have a crucial role in facilitating global communication and empathy.

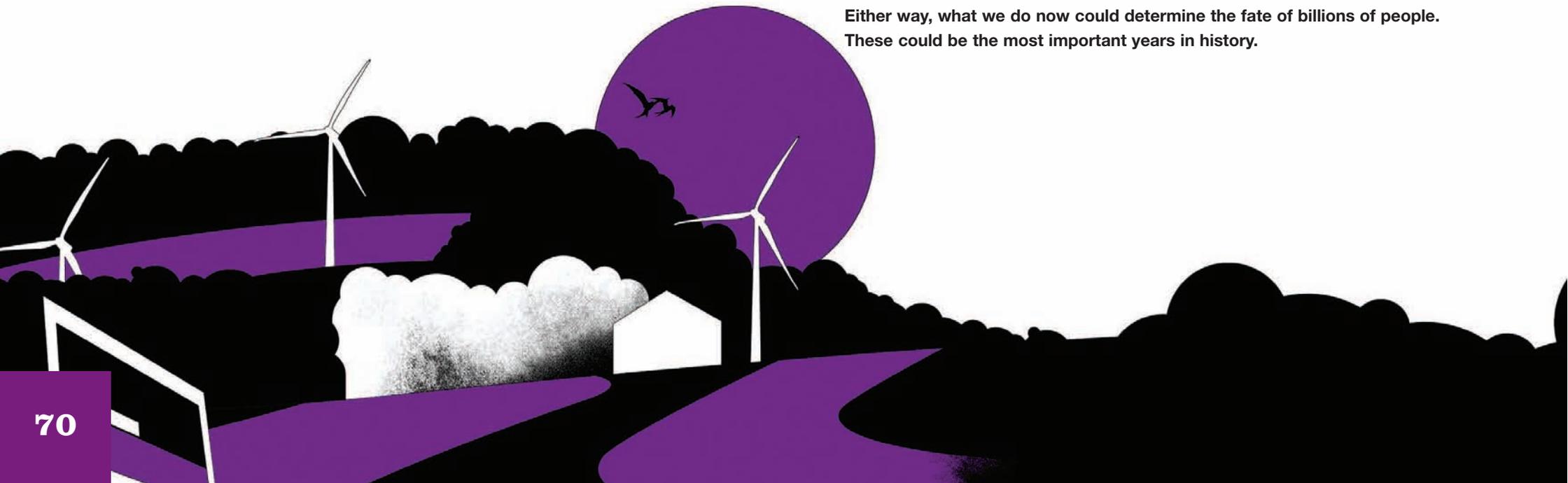
Take a systemic view of the operating context. Strategies designed to address climate change could fail if they work against the grain of other strategies. New business models, products and services should be designed for success in a climate-changing world, in all its social, economic, political and psychological complexity. Using scenarios such as our *Climate Futures* scenarios can help with this.

the most important years in history?

Our scenarios are based in part on the latest IPCC reports from 2007, which drew on science from the previous years. They are already out of date. The most recent science says climate change will go further and faster. We are closer to the thresholds than we thought. What's more, indirectly related impacts that our interviewees said were long-term – food riots, import tariffs, oil at \$150 – are happening now.

We have said that the historians of the future will call these the climate change years. But what sort of world – which of our scenarios, or what blend of our scenarios – will those historians be living in? If it resembles Protectionist World, they may look back at us with a complete lack of comprehension or even disgust, rather as we look back on slave-owners. Or if climate change feels solved, or on the way to a solution, they may look back on us as heroes.

Either way, what we do now could determine the fate of billions of people. These could be the most important years in history.



appendices

using climate futures scenarios

Contemplating a range of possible futures is an important part of any strategic thinking, particularly in a period of volatility. All organisations need to be prepared.

Scenarios offer plausible, internally consistent, possible futures – they provide multiple perspectives that highlight a range of uncertainties. As such, they can be useful ‘thinking tools’ to encourage long-term thinking, communicate aspirations, build consensus, and ultimately develop strategies that can be robust in any future. Using the scenarios is one way of creating ‘prepared minds’ which have a systemic view and are ready to respond as circumstances change.

Our scenarios have been compiled based on the opinions of more than 60 experts on how climate change could develop, and what the resulting challenges might be in the future. The resultant worlds are not predictions; there is no best case or worst case scenario, and there is no business-as-usual scenario. Each scenario is a different picture of what is possible in 2030 and has both positive and negative features.

So what might they mean for your business or organisation? The implications will no doubt be particular to your operations and no single individual can be aware of all your strengths and weaknesses. Instead, these scenarios, and the questions below, might be used as the basis for a workshop or other discussion, a springboard for ideas to explore possible challenges and opportunities that climate change presents.

1. thinking about the future: risks and opportunities

Business-as-usual does not exist in any of the scenarios. So, how are your current operations exposed?

How successful would your current strategy be in each of the scenarios? Can you conduct an analysis of the strengths, weaknesses, opportunities and threats for your business in each scenario? How could the strategy change to make it more robust in 2030; how might you need to adapt to manage the risks and capitalise on the opportunities?

If you look at your supply chain, can you see where you will get your raw materials? What will happen if non-renewable energy prices increase? How will climate change reshape the countries you work in, the people who work for you, and your suppliers’ countries and staff? How will your customers react? Will there still be demand for your current products and services?

Which other products or services might be successful in each scenario? How might they be developed – could you draw a roadmap for the product idea that works for all the scenarios?

Most companies plan for at most five years into the future. But your decisions now will affect the ability to be successful for longer than that. Companies tend to plan for a future that is like today, but bigger. Climate change will make many of those assumptions meaningless. Instead, those organisations that place long-term thinking at the heart of their strategies will be best prepared to thrive in any future.



2. setting yourself up for success: rewarding leadership

No one company can address climate change alone. It needs the different actors who affect and are affected by the company to be involved.

Investors. Do they understand the risks to the business? How can you help them to understand why addressing climate change is in their interests?

Regulators. How can you work with them to create a system which incentivises a low-carbon economy?

Peer companies. What can you do to create the space for others to act? The focus for 2009 must be on creating a 'post-Kyoto' agreement, otherwise there will be no global system from 2012.

Customers. How can you satisfy and form their needs for profit and with low-carbon solutions?

Supply chain. How are you encouraging them to reduce your exposure to climate change risk and to increase your opportunity?

Your organisation. How are you setting yourself up for success? Do your people have the talent, skills and incentives for addressing climate change?

How is climate change addressed in your organisational architecture – the organisational chart, the formal tasks in job descriptions or divisions, the financing, the governance, and the informal networks? How do the formal and informal routines, like managerial procedures, performance monitoring and decision-making, address climate change? What does climate change mean for your culture – shared norms, language and mindsets that suffuse how the organisation works?

The successful businesses of tomorrow will be those that have faced up to the challenges today, driving change and rewarding leadership.

Success in the coming decades will require rewarding leadership and championing change today. The most pertinent implication of this report must be that doing nothing is simply not a realistic option. So those businesses that face up to the challenges now will secure the firmest foundations to face any of our *Climate Futures*.



some further reading

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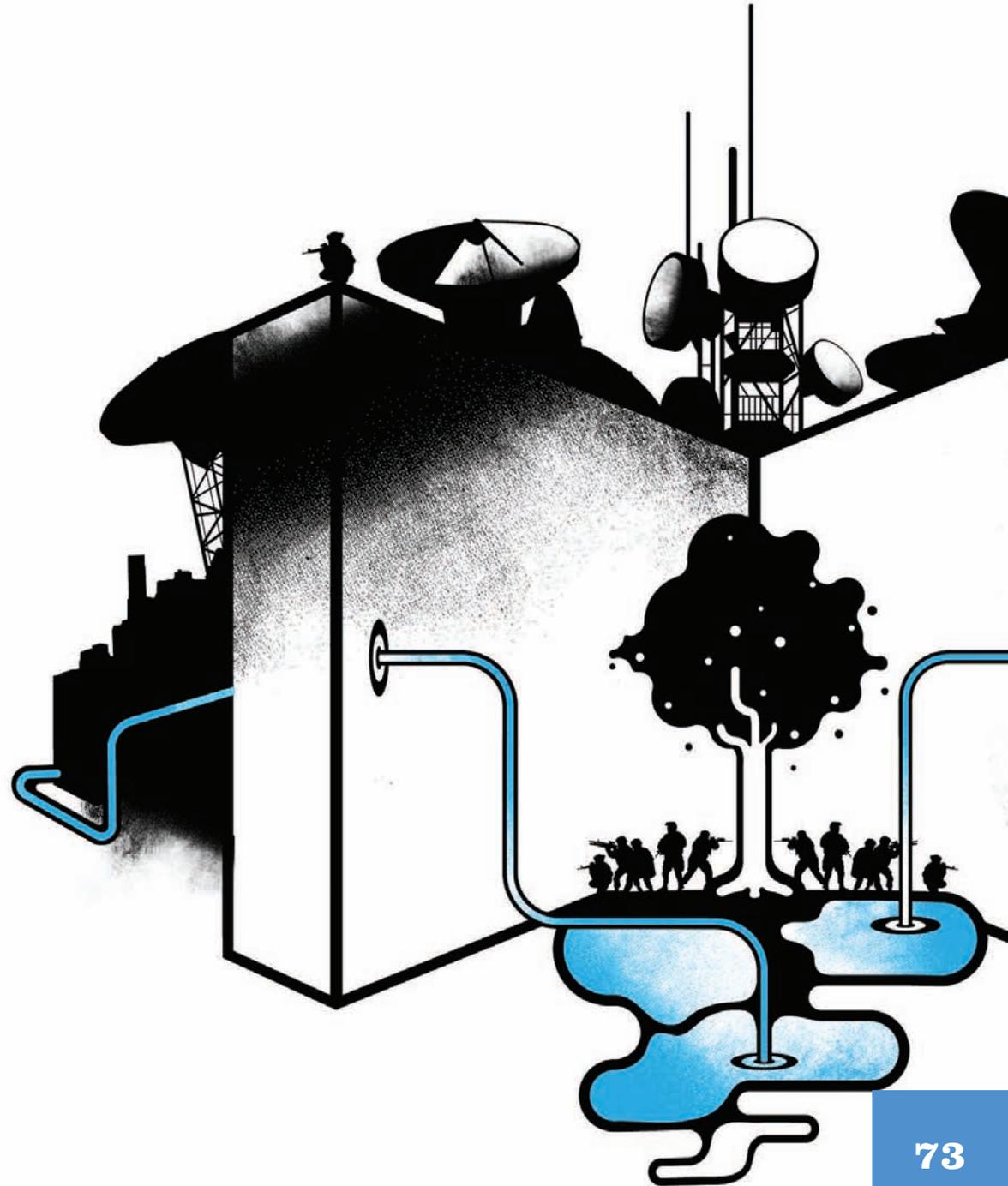
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list of people consulted

We are very grateful for the contributions made to this project by the following, either through being interviewed or by participating in one of our workshops.

Interviewee

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Stephàn Isoard
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Balsillie School of International Affairs in Waterloo, Canada
BBC
Carbon Disclosure Project
Carbon Disclosure Project
Carbon Disclosure Project
Carbonsense
Centre for Action Research, University of Bath, UK
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Citigroup Global Markets, Mumbai
Climate Group
CSR Asia
Entec
Environment Agency
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European Commission
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Tom Burke
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Daniel Gagnier
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David Runnalls
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Sir Crispin Tickell
Chris Hope

Dr Robert Falkner
Mark Bunger

Green Futures Magazine
Hewlett Packard
Rio Tinto
Institute of Ideas
International Centre for Corporate Social Responsibility
International Institute for Sustainable

International Institute for Sustainable

International Network of Resource Information Centers; Atkisson Group
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Pollution Probe (Canada)

Practical Action Bangladesh

Practical Action Nepal

Quantum Consultancy

Recurrent Energy

Rocky Mountain Institute

RSA

Forum for the Future

Sustainable Development Commission

The Guardian

The Idea Factory

UNEP's Risoe Centre on Energy,

Climate and Sustainable Development

University of Bath

University of Bath

University of Bath Business School

University of Cambridge

Programme for Industry

University of East Anglia

University of Exeter

University of Oxford

University of the West of England

University of Tokyo

WWF



