

# The ABC of Carbon

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## *Introduction*

*Ken Hickson considers ...*

### Carbon and climate on a collision course

**Carbon** — the first and last word in this book. Literally and intentionally. It is the basis of life on earth, and we will learn when we dig deeply on the subject — just as archaeologists go on digs and coal miners dig up the black gold — that carbon is used and abused in many different ways. Chemistry and encyclopaedia will tell us how essential and versatile carbon is, and that it comes from the Greek word *carbo*, meaning ‘burnt wood’ — but does that mean we should burn as much of it as we can? Interestingly, the carbon that formed many millennia ago (from the plants and trees in the swamps of the *carboniferous* period) is the hydrocarbon — the coal, gas and oil — we exploit today. In many ways, carbon was designed to be burnt, because it is through this process that it combines with oxygen to produce carbon dioxide (CO<sub>2</sub>) — and we wouldn’t have life on earth without it. So, the essential carbon cycle goes around and around.

### Greenhouse effect

So, what’s gone so wrong today that warrants the suggestion that carbon is on a collision course with climate? We are taking too much of the carbon out of the earth, burning it and producing excessive amounts of CO<sub>2</sub> — more than can be absorbed by soils, plants, trees and oceans. Joining with other gases, CO<sub>2</sub> settles as a layer of gas in the upper atmosphere, retaining more heat than the earth needs and preventing the excess energy escaping. This is called the greenhouse effect because the gases — primarily CO<sub>2</sub> — act like the glass of a greenhouse. The consequence is rising temperatures on earth. This in turn creates problems, such as glaciers melting faster and an increasing incidence of severe weather events.

**Peter Doherty**, winner of the Nobel Prize for Physiology and Medicine in 1996 and author of *A light history of hot air* — ‘Carbon takes many forms in nature, including the graphite that goes to make lead pencils and the diamonds that we use to celebrate beauty and commitment, but the most important role for carbon so far as we are concerned is to serve as the scaffold of life.’

## Abrupt and irreversible

Global warming is happening now at a rate faster than predicted - the rate of increase of CO<sub>2</sub> in earth's atmosphere is happening faster than at any time in the past 650 000 years. We know this from ice core samples taken from the Arctic and Antarctic, allowing us to trace temperatures and CO<sub>2</sub> levels back through time. That's enough of the science of global warming and climate change. It is a fact and it's getting worse. In February 2007, the new Secretary General of the UN, Ban Ki-moon, had this to say about climate change: 'Much more must also be done by governments, business and civil society. The world needs a more coherent system of international environmental governance. We need to invest more in green technologies and smarter policies.' A few months later, on the release of the latest report from the Intergovernmental Panel on Climate Change (IPCC) on 17 November 2007, he was moved to challenge governments to act on IPCC's findings. He said real and affordable ways to deal with the problem existed, quoting the IPCC that climate change is 'unequivocal' and may bring 'abrupt and irreversible' impacts. He urged politicians to respond at the UN Climate Change Conference in Bali (in December 2007): 'Today the world's scientists have spoken clearly and with one voice. In Bali, I expect the world's policymakers to do the same.'

## Watershed year

Before Bali there was Kyoto. And before Kyoto there was Rio. Toronto came even earlier to deal with the ozone dilemma. So, what has been going on in past years since there was first talk of the greenhouse effect, of global warming and of climate change? What brought it all to a head and made 2007 a watershed year for global awareness of climate change? Surveys by a range of business and community organisations in both developed and developing nations have been saying conclusively that the majority of the population now believe that climate change is one of the most serious issues faced by humanity. What was it that raised awareness so suddenly and so dramatically? It certainly wasn't the work of governments, who — with one or two notable exceptions — have been noticeably reluctant to advocate, act or inform at home or abroad. However, the UK and its European partners have certainly been ahead of the game. International organisations, mainly UN agencies, have done their best, but we have to say that until 2007 their messages haven't been clear and concise enough to make people take notice.

**Al Gore**, former US Vice President, Nobel Peace Prize winner (along with the IPCC), Oscar winner and author of *An inconvenient truth* — 'The problem we now face is that this thin layer of atmosphere is being thickened by huge quantities of human-caused carbon dioxide and other greenhouse gases. And as it thickens, it traps a lot of the infrared radiation that would otherwise escape the atmosphere and continue out into the universe.'

## Early alert

For we now find out — if we start to explore the wealth of material and sources — that the climate change/global warming issue has been recognised and talked about for 20 years or more. Australia organised its first Greenhouse conference in 1987 when scientists, including those associated with the Commonwealth Scientific and Industrial Research Organisation (CSIRO), drew attention to the science and reality of global warming. Professor Ian Lowe's landmark book, *Living in the greenhouse*, was published in 1989, alerting people that global warming was a serious issue for Australia and the world. When the Rio Earth Summit was held in 1992, it set in motion the UN Framework Convention on Climate Change (UNFCCC). Why did it take so long for the message to sink in? Suspicion centres on scientists whose nature it is to question each other — maybe they didn't feel they had enough conclusive evidence, authority or courage to come out with it. Maybe it was the politicians and the bureaucrats — in international organisations and closer to home — who, not wanting to hear the bad news, sent the scientists back to get more facts and figures.

**Rajendra Pachauri**, engineer, economist and chairman of the IPCC, which received the Nobel Peace Prize (along with Al Gore), was described in this way by the *Times of India* on 13 October 2007 — 'He did for IPCC and climate change what many scientists fantasise about their work — he mainstreamed it with plainspeak. His mix of academia and advocacy ensured that the fourth assessment report of IPCC became more than a grand assessment of science on climate change authored by more than 400 scientists. It became the new-age Bible.'

## Perfect problem

Maybe it was all because this represented 'a **perfect problem**' — one that crosses all scientific boundaries and geographic borders. This point was made and dealt with by Yale School of Forestry and Environmental Studies when in 2005 it brought together 110 scientists, journalists, politicians and activists. Together they produced a report entitled *Americans and climate change* that asked the question: 'Why has the robust and compelling body of climate change science not had a greater impact on action, especially in the US? From the policymaking level down to personal voting and purchasing decisions, our actions as Americans have not been commensurate with the threat as characterised by mainstream science. Meaningful pockets of entrepreneurial initiative have emerged at the city and state level, in the business sector, and in "civil society" more generally. But we remain far short of undertaking the emissions reductions that scientists say are required if we are to forestall dangerous interference in the climate system on which our civilisation depends. The problem of climate change is almost perfectly designed to test the limits of any modern society's capacity for response — one might even call it the "**perfect problem**" for its uniquely daunting confluence of forces, including complex and inaccessible scientific content, and a substantial (and uncertain) time lag between cause and effect.' There's much more in the Yale report. Importantly, the group not only identified the **perfect problem**, but worked on solutions and recommendations for action.

**Stephen Schneider**, climatologist and author of numerous books, including *Global warming: are we entering the greenhouse century?* from an interview on ABC's Lateline programme in October 2007 — 'Clean coal has to be a part of it. But we've got to have other alternatives. Energy efficiency and performance standards. Cars on a diet and alternative energy systems. Efficient transmission lines and plug-in hybrid automobiles moving toward fuel cells. So, it's a bunch of things.'

### Serious time lag

While we are not in the 'blame game', we must wonder why has it taken so long — the best part of 20 years — for the world to be finally roused from slumber to act on climate change. Clearly there has been sufficient knowledge around for some time to know that something is seriously wrong with the way human activity is affecting our climate — and the consequences are drastic. Day by day this grows more serious, because scientists tell us that whatever we do now to reduce our greenhouse gas emissions will not change things for perhaps 30–50 years. The carbon dioxide in the atmosphere will take as long as that to disperse. That is serious. So why wasn't the world told before now? We also know that another Nobel Prize winner, Svante Arrhenius, established a long way back — in 1895 to be exact — that there was a 'greenhouse effect'. He predicted what would happen if industrial emissions grew enough to double the amount of carbon dioxide in the atmosphere. That's 122 years to ponder the problem! And while countless hours have been expended by scientists the world over researching climate change, multitudes of trees have been felled to produce the paper to print the reports — along with a vast number of hours of computer time and the concurrent energy use. Just as scientists can rarely agree among themselves at the best of times, bringing them together from different climes and cultures with different degrees of experience in the ways of international agencies, conferences and collaborations, creates more complications. It has been a long, torturous, expensive and not an entirely efficient way to reach earth-shattering conclusions. A necessary evil, maybe. But throughout the prolonged process, the various committees and conferences have either lacked the authority, political will or communication skills to effectively get messages across.

### Big picture

The world at large has gained a better appreciation of the big picture of climate change from the likes of Nicholas Stern (the *Stern Review* was released in October 2006) and Al Gore (whose book and documentary, *An inconvenient truth*, were released in mid 2006). Their reports while perhaps lacking some of the science and time-taking peer reviews — have actually had much more impact and reached society in general so much more effectively. Gore has been criticised for not being totally correct with some of his 'facts'. Stern has had his critics for viewing it all through the eyes of an economist. Now, of course, we can look back and congratulate the IPCC and UNFCCC for the work they have painstakingly and laboriously undertaken over the years. Finally, when all the reports and documentation were uncovered — the final 'synthesis' report was released on 18 November 2007 — most concurred with the more graphic 'big picture' portrayals of Gore and Stern. The IPCC work also confirmed what others like Ian Lowe and Tim Flannery have been saying from Australia for some years — and what American Stephen Schneider has been proclaiming endlessly: that climate change is a fact and that human activity has contributed largely to a worsening climate. Things are not going to get better for a long time, but we must move to substantially reduce the dangerous levels of greenhouse gas polluting the atmosphere.

**Nicholas Stern**, head UK economist and former World Bank chief economist, author of *Stern Review* on the economics of climate change — ‘Even with very strong expansion of the use of renewable energy and other low-carbon energy sources, fossil fuels could still make up over half of global energy supply in 2050. Extensive carbon capture and storage will be necessary to allow the continued use of fossil fuels without damage to the atmosphere.’

## Recognition

Of course, the IPCC was deserving of the Nobel Peace Prize (jointly with Gore), but maybe others like Stern, Schneider, Lowe and Flannery should also be internationally recognised for bringing this out in the open and not waiting for official endorsement. As we saw at the UN Conference on Climate Change in Bali (early December 2007), representatives of governments present accepted the science (and the implications) of the officially recognised reports and agreed to take the steps which had been resisted for so long. The ‘Bali Roadmap’ became the way to move ahead. Delaying action on climate change by countries before and after Bali had not been just a matter of the US and Australia not ratifying Kyoto even though Australia finally did honour Kyoto early 2008 — but due in a large part to the lack of effective communication at all levels. Is this the fault of scientists, of those communicators engaged by the UN and its agencies, of governments, or the media? While all must share some responsibility, it is a fair observation that maybe the media was not fully engaged early enough or given access to information in a form that was newsworthy.

**Tim Flannery**, 2007 Australian of the Year, palaeontologist, author of *The weather makers* — ‘The places that the carbon goes to when it leaves the atmosphere are known as carbon sinks. You and I and all living things are carbon sinks, as are the oceans and some of the rocks under our feet. Cold sea water can hold more carbon than warm sea water, so as the ocean warms it becomes less able to absorb the gas.’

## Business leadership

Nor was business engaged as it should have been. Business and industry, the professionals, along with the important non-government organisations (NGOs), should have been drawn into the consultation process early on. Because, perhaps surprisingly, it has been the NGOs and business who have stepped in — often without access to all the facts — to act, to communicate, to establish priorities and to raise awareness. Businesses have put into place policies and practices to cut emissions and energy use. No one has told the business community or industry what it must do, but they can see what’s on the horizon and they know that they have to share in the responsibility and the risks. Business being business knows how to act decisively, even if not equipped with all the science it could do with. All credit to those business leaders — who know that leadership means taking risks and taking action. Taking action for their own good, as well as for their shareholders, partners, clients and customers. Rupert Murdoch, Ray Anderson and Richard Branson would be three notables to stand out; their policies and declarations of action are noted elsewhere in this book. It would make sense to get business people of their ilk to help form a new international organisation that brings together the energy and economic edge of business, the enthusiasm of NGOs and outstanding individuals, with the appropriate UN agencies, including the World Bank, to focus exclusively on carbon and climate change. Let’s call it the International Carbon Enterprise, or ICE.

## Clarify and demystify

Remarkably, criticism of the scientific communication process has come from scientists themselves — the delays in raising general awareness of climate change have been noted. Geoff Garrett, when head of Australia's CSIRO, admitted at the Greenhouse 2007 conference in Sydney that the scientific community had not communicated this issue as effectively as it should have done. He chose 'communication' as a key message and called on his fellow scientists to 'clarify and demystify' their research findings. At the same conference, many other leading scientists agreed that there had been a communication breakdown. Maria Taylor of the National Centre for the Public Awareness of Science at Australian National University spoke of the lack of media and community awareness in the 20 years between 1987 and 2007. She pointed out that Australia gained public awareness on climate change and then lost it. She refers to a period of 'public discourse of confusion, indifference and denial'. Ann Henderson-Sellers of the World Climate Research Programme put it more bluntly, imploring scientists and their employers to engage and advocate more — to get the climate change action message across. Then there was the ultimate science communicator, a 'gentle giant', Bob Henson, telling the conference about the way he approaches his job in the US, for the National Center for Atmospheric Research, with his journalism and scientific training. He spoke of the importance of the media and the message.

**Ann Henderson-Sellers**, then director of the World Climate Research Programme (now ARC Professorial Research Fellow, Climate Change Risk Research, at Macquarie University, Sydney), addressing the Greenhouse 2007 conference in Sydney — 'Effective global governance so urgently needed in relation to greenhouse climate change is not developing, in part, because climate research scientists are failing to communicate well. They need to be more like doctors advising cancer patients on treatment.'

## Communication

To communicate effectively, then, is a clear objective of this book — to pull together (from every conceivable source) as many of the threads as possible. From the mainstream media, from the scientists, from the authors on related subjects, and from the many old and new NGOs that are encouraging awareness and urging individual, community and country action on climate change. It is probably true to say there is not anything original in this book, but it attempts — in a form that has not been done to date — to set out chapter by chapter, paragraph by paragraph, in an alphabetical, even encyclopaedic fashion, a chronicle of all that we need to understand about climate change and the carbon we talk so much about. This book discusses the 'issues and opportunities in the global climate change environment' and in doing this, we find out through a series of mini case studies — what business and industry are doing. We explore energy uses and abuses, as well as all new and known renewable sources — not forgetting the role played by fossil fuels. Hopefully, this book with its short summaries and simple language will reach out to a wider community. We also delve into the ingenious and the innovative when it comes to carbon, as well as technology. There is also a little trivia to break up the heavy material with some light relief. Let me make it clear that what I have decided to include is by no means the end of it. Access points to the sources are provided, for verification and for further information. It also needs to be pointed out that while I aim to be as timely as possible — to deal with current issues, news and comment — I have tried to set a deadline for when to stop reporting. Originally it was end 2007, when much of the material had been gathered. Then it carried on through 2008 and continued through the first few months of 2009. But the story goes on, just as the debate will go on, after Bali, as well as before and after Copenhagen's momentous meeting December 2009.

**Bob Henson**, journalist, meteorologist, science communicator for the National Center for Atmospheric Research, storm chaser and author of *The rough guide to climate change* and speaker at Greenhouse 2007 urged his fellow scientists to —‘Translate the science. Convince the sceptically inclined. Instil concern. Motivate people to act. 2007 has been the year of climate change — but our work is not done.’

## Age of Carbon

What becomes apparent when exploring climate change is the enormous and central role played by carbon in the past and well into the future. It is like discovering gold. Suddenly, everyone is talking about it, discovering what carbon dioxide is all about, and measuring and reducing their carbon footprints. So much has carbon come into vogue and into the world’s vocabulary that it warrants recognition. This century could well be acknowledged as nothing less than the ‘**Age of Carbon**’, just as we have acknowledged in the past the Iron Age and the Space Age. There is no other time in history when carbon was so important. Carbon has been always present — it is essential for life — but now it’s on the loose and out of control, with the potential to damage the earth for all time. We are talking about carbon as a product and as a fuel, as well as carbon dioxide, the gas, which is in over-abundance in our atmosphere. To be aware of its power — carbon’s contribution to global warming and consequential climate change — is to wake up to how we can better manage the resources that we have at our disposal. Human activity — our misuse of available energy, resulting in excessive carbon dioxide emissions — has undoubtedly changed our climate and damaged our environment. But there is hope. However, it is the responsibility of all of us to grasp the opportunities we have to change things for the better — and to do it now. Carbon can be our friend. With millions of words on the subject of carbon and climate change already written, the reader could be forgiven for thinking enough is enough.

**Ian Lowe**, president of the Australian Conservation Foundation, scientist, member of the IPCC and author of *Living in the hothouse* — ‘Coal is mainly carbon, with small amounts of other elements like hydrogen. When it is burned, the carbon combines with oxygen in the air to form carbon dioxide. Burning a tonne of coal produces 3.7 tonnes of carbon dioxide. More to the point, burning about 100 million tonnes of coal (as we do each year in Australia, mainly to generate electricity) produces 370 million tonnes of carbon dioxide.’

## Innovate and investigate

This is the beginning — not only of this book, but of the journey to explore and come up with answers. We need to innovate and investigate. This is not the sole responsibility of scientists. Businesses large and small have already shown a willingness to engage in and act on climate change mitigation and adaptation. Inventors and researchers of all persuasions have the opportunity to come up with remedies and products that might capitalise on the over-supply of carbon — and turn it into peaceful objects of mass production. Technology is being applied to new and renewable forms of energy, as well as effective means of burying CO<sub>2</sub>. There are also serious attempts to revisit some age-old means of transport that involve zero fossil fuels and more active use of people power. It may even be possible to fix two modern-day excesses at the same time obesity and energy. Sir Richard Branson is offering a handsome prize to anyone - or any group - who can master the climate change problem. But the biggest prize is surely a future for the earth. A climate in which we can all live comfortably and in harmony. I’ll finish this introduction on the next page with the words of a great man, who was not speaking about climate change, but about action and inaction on anything that matters.

*We are now faced with the fact that tomorrow is today. We are confronted with the fierce urgency of now. In this unfolding conundrum of life and history there is such a thing as being too late. Procrastination is still the thief of time. Life often leaves us standing bare, naked and dejected with a lost opportunity. The 'tide in the affairs of men' does not remain at the flood; it ebbs. We may cry out desperately for time to pause in her passage, but time is deaf to every plea and rushes on. Over the bleached bones and jumbled residue of numerous civilizations are written the pathetic words: 'Too late . . .'* Reverend Dr Martin Luther King, Jr (1929–1968)

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