

BOOKS & ARTS

What just ain't so

It is all too easy to underestimate the challenges posed by climate change.

Kicking the Carbon Habit: Global Warming and the Case for Renewable and Nuclear Energy

by William Sweet

Columbia University Press: 2006. 272 pp.
\$27.95

Roger A. Pielke, Jr

One of Al Gore's favourite sayings comes from Mark Twain: "It ain't what you don't know that gets you into trouble. It's what you know for sure that just ain't so." I thought of this when reading journalist William Sweet's *Kicking the Carbon Habit*. The book contains an interesting and thoughtful overview of climate science, but concludes with a fundamentally flawed discussion of climate policy.

Unlike many advocates and scientists, Sweet is respectful of his readers in not relying on false claims of certainty about the state of climate science. Although the introduction includes what now seem to be mandatory (yet misleading) references to Hurricane Katrina and Kilimanjaro, the middle part of the book discusses climate science in greater depth, and explains quite refreshingly and accurately that the "seeming unanimity among scientists is, in truth, somewhat deceptive". He acknowledges that uncertainties work in two directions: future climate change could be much more benign than many currently think, or it could be worse. He makes a convincing case that a thoughtful individual can recognize that there are vast uncertainties in climate science, particularly with respect to how the future will evolve, yet still believe that human influence on climate is a problem worth our attention and action.

The book's discussion of policy is regrettably grounded in a fundamental error that surprisingly was not caught in the review process. Sweet, like many others, focuses his policy discussions on recent work by Princeton University's Steve Pacala and Robert Socolow. To present a conceptually clear description of the challenges of reducing emissions growth in the coming decades, Pacala and Socolow described 'stabilization wedges', each of which represents one-seventh of the accumulated future emissions above today's levels out to 2054. They then used the concept of the stabilization wedge as a measuring stick against which to compare 15 policy options; each one could, in principle, result in emissions reductions equivalent to



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Power shift: tackling climate change will mean reducing our reliance on fossil fuels.

one 'wedge'. Pacala and Socolow argued that successfully displacing seven such wedges over the next half-century would be enough to keep open the possibility of stabilizing carbon dioxide concentrations at a level less than twice the pre-industrial value, or about 550 parts per million (p.p.m.). In 2006, carbon dioxide levels are about 380 p.p.m.

However, instead of interpreting Pacala and Socolow's work as offering a trajectory of future emissions that keeps open the possibility of stabilization below 550 p.p.m., Sweet has (mis)interpreted it to mean that seven wedges are "required to stabilize global carbon dioxide at double their pre-industrial value". He seems to have confused some proposed first steps with an act that can deal with the entire challenge. This confusion leads to a dramatic underestimation of the challenge of stabilizing carbon dioxide concentrations at less than twice their pre-industrial value. Sweet suggests incorrectly that breaking the carbon habit can be achieved by implementing 7 of Pacala and Socolow's 15 proposed stabilization-wedge policies: "If the reader accepts only half what [Pacala and Socolow] propose, the problem of greenhouse gas stabilization can in principle be solved."

For their part, Pacala and Socolow recognize that what they have proposed is only a start,

writing that even after the successful implementation of seven of their wedges by 2054, "fossil fuel emissions must decline substantially". But by how much? According to Pacala and Socolow, by about an additional two-thirds over the subsequent 50 years. *Kicking the Carbon Habit* has thus confused stabilizing emissions with stabilizing concentrations — a common error that may have been encouraged by Pacala and Socolow's potentially misleading terminology of 'stabilization wedges' and "solving the climate problem for the next 50 years". The effects of this confusion lead to a misunderstanding of the practical challenges in stabilizing carbon dioxide levels.

In reality, stabilizing carbon dioxide emissions at current levels, as suggested by Pacala and Socolow, would result in a continued linear increase in atmospheric concentrations because carbon dioxide emissions would still far exceed their rate of removal by the oceans and land. Upon completion of the seemingly herculean task of reducing projected global emissions by more than 50% by 2054, by successfully avoiding seven wedges, we would still face the challenge of reducing the remaining level of emissions by another 64% over the next 50 years. To put the stabilization challenge in stark terms, under Pacala and Socolow's most optimistic assumptions for stabilization

at 550 p.p.m., the world will need to reduce its projected business-as-usual emissions by about 1,000 gigatonnes of carbon over the next century. Seven stabilization wedges worth would achieve 175 gigatonnes, leaving a considerable gap, even if the total business-as-usual emissions have been overestimated by a factor of two or more.

It is perhaps Sweet's underestimation of the magnitude of the challenge that leads him to dismiss the prospects for renewables and carbon sequestration in favour of a focus on reducing the emissions from coal. If stabilization at twice pre-industrial levels is to happen, not only will a focus on coal, renewables and sequestration be needed, but many experts argue that there will need to be a fundamental transformation of the global energy system. Based on its misplaced optimism of a relatively quick and easy fix, *Kicking the Carbon Habit* quickly dismisses such perspectives.

Many believe that if climate change can be dealt with relatively easily, then there would also be little need to adapt to it. This sort of thinking may explain why the issue of adaptation plays no role in the book. Overlooking adaptation in any discussion of climate policy is a sign that the challenge posed by climate change has been fundamentally mischaracterized — not only because the world is already committed to some degree of climate change, but also because adaptation makes sense under any future climate scenario.

In the end, *Kicking the Carbon Habit* is a deeply flawed book with considerable potential to mislead its readers about policies related to climate change. This is a shame because its discussions of climate science are both entertaining and informative. ■

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interested in developing phage therapy.

Much of this information will be useful for professionals as well as the general public. For example, I was interested to read of the progress made by Omnilytics (a company based in Salt Lake City) in the use and commercialization of phage for the treatment of bacterial spot disease in tomatoes.

However, like many 'popular' science books, the book often lacks a critical analysis of the information presented. For example, Häusler suggests that the spleen filters most phage from the circulatory system, whereas this task is largely done by the liver. He underplays the role of phage in causing human disease. He notes: "Prior to 1900, diphtheria was the most frequent cause of death for German children." Two pages later he states that "phages are viruses that only attack bacteria". He doesn't mention in this context that diphtheria toxin is encoded in a phage genome, so diphtheria is primarily a phage-associated disease. He also implies that the use of lysozymes to kill bacteria is new, but they have actually been used as food preservatives for decades. And there is no merit to his claim that lysin treatment, unlike antibiotic treatments, does not generate resistant mutants. Under laboratory conditions it might be hard to obtain the mutations needed to confer lysin-resistant phenotypes. But as most resistance comes from acquiring new DNA elements from nature, it is easy to see how the overuse of any lysin or antibacterial agent will select for those resistant elements that exist in nature, as has repeatedly happened before.

A more worrying aspect is Häusler's overuse of anecdotal cases. Although he states in the book's preface that the book "is not a health manual whose purpose is to testify to the efficacy of phages", he refers to specific anecdotal cases in a way that suggests that phage therapy was indeed responsible for the reported clinical improvement. These treatments were often carried out in clinical settings that do not meet

The road to phage therapy

Viruses vs. Superbugs: A Solution to the Antibiotics Crisis?

by Thomas Häusler

Macmillan Science: 2006. 256 pp.

£16.99, \$24.95

Sankar Adhya & Carl Merril

The first evidence for a viral-like agent with antibacterial properties was reported by M. E. Hankin in 1896. Found in the Ganges river in India, it was temperature sensitive, capable of passing through a porcelain filter, and could reduce titres of the bacterium *Vibrio cholerae* in laboratory culture. Hankin suggested that it might help to decrease the incidence of cholera in people using water from the Ganges.

The viral nature of such antibacterial agents became clearer following the observation of agents capable of lysing bacterial cultures by Frederick Twort and Felix d'Herelle in 1915 and 1917, respectively. It was d'Herelle who named these agents bacteriophages and championed their use in treating infectious diseases. He and his colleagues introduced phage therapy throughout the world, with major efforts in India, Egypt, the United States and the Soviet Union. Unfortunately, these clinical applications were initiated before certain microbiological aspects of phage strains, such as their narrow host range, were fully appreciated. In addition, clinical investigations in the 1920s and '30s were based largely on anecdotal evidence — scientific and statistically relevant clinical trials were only introduced in the 1940s, primarily in the United States and Britain. The clinical use of phage therapy without the underlying scientific support needed to assure a high level of clinical effectiveness, combined with the development of antibiotics during the Second World War, served to

marginalize the use of phage therapy in most Western countries.

There have been many reviews of phage therapy and some books, but few provide the historical details that Thomas Häusler introduces in this volume. For example, he mentions reports published in the journal *Der Deutsche Militärarzt* during the Second World War on a phage preparation known as 'polyfagin', which was produced by the German pharmaceutical company Behringwerke as a treatment for dysentery. And he reveals that the research of René Dubos on phage therapy in 1942 was supported by a committee of the US National Research Council that was "assigned the task of keeping the country prepared for war". He also interviewed many of the researchers and business entrepreneurs who have been



Troubled waters? Bathers in the Ganges were thought to be protected from cholera by phage.

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