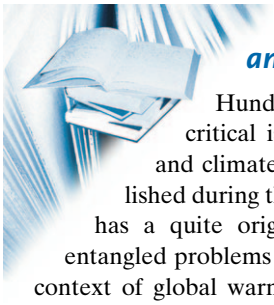


Energy Demand and Climate Change

Hundreds of books on the critical issues of energy demand and climate change have been published during the last decade. This book has a quite original approach to these entangled problems: "In the long run, in the context of global warming versus ice ages, ice ages are very likely going to win and glaciers will start returning again, just as they have many times in the past. Is it possible that humanity would have to endure another ice age with only wood fires for heat as we did before?"

Franklin Hadley Cocks, an engineer at Duke University with a multidisciplinary background in materials science and technology, acknowledges that anthropogenic carbon pollution is altering the Earth's climate and explains this very complex process in a clear fashion. But additionally, and originally, he points out that the climate of our fragile planet is governed by long-term (millennia time-scale) astronomical dynamic processes that are generally overlooked in the current climate/energy debate. The combination of the Earth's orbit and its tilt and wobble motions has driven the sequence of ice ages and warm ages over millions of years; our modern hypertechnological confidence should not lead us to forget that we are still affected by this natural mechanism.

At the beginning of the 21st century we are enjoying an unprecedented energy fiesta, in the context of a golden period of climate that started about 12000 years ago. Unfortunately for posterity, the present era of mild climatic conditions will come to an end in a few thousand years. At that time, no matter how massive our CO_2 pollution might be, polar glaciers will slowly begin to grow again and progressively cover land and oceans. Brutally put, not only is human civilization poised to experience one climate nightmare (man-made and hot) but also, worryingly enough, this will be followed by a second nightmare (natural and cold). With this perspective, brilliantly illustrated in the first section of the book, it is not difficult to persuade anyone that we must phase out our fossil-fuel dependence and pursue a tough energy transition. After all, it would not be exactly rational to keep on using resources that are triggering a hot nightmare and, when it has become completely exhausted, will leave humans freezing during the next cold incubus, if a reliable plan-B scheme is not worked out.

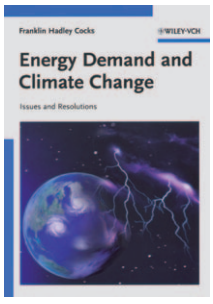
Scientists often blame decision makers for being unwilling to implement far-sighted energy and climate policies. In this book there seems to be an opposite excess: perhaps there is no point in worrying about the climate of our wonderful planet in 2–3 millennia from now if we have no idea about the state of our civilization (if any) in that distant future. Nonetheless, this long-term climate scenario is intellectually stimulating, and is a useful pretext for the author to describe all possible energy technologies that might spare humanity such a gloomy future. This is the central and largest part of the book, which is divided into a description of existing energy options (Section II, "Answers") and a description of those that might someday become reality (Section III, "Dreams").

The discussion of energy technologies is indeed comprehensive: from fossil fuels to nuclear energy, from solar to geothermal, wind, waves, tides, biofuels, batteries, fuel cells, artificial photosynthesis, improved energy efficiency, and much more. It is indeed cheering to realize how many energy options we have, albeit many of them still at an infancy stage. Given the wide variety of technologies considered, they are inevitably presented, in most cases, in qualitative terms: not a single equation is found throughout nearly 250 pages. But this is not necessarily a shortcoming for a book on fundamental subjects that aims to reach a wide readership.

Probably the least convincing part of this book is the "Dreams" section, where nuclear fission breeding reactors are put at the top of the list. No mention is made of the fact that breeding technology has been an economic fiasco up to now, nor that during the last 40 years the nuclear fission industry has eaten up 60% of energy R&D spending, while providing only 6% of the present total primary energy supply. Geo-engineering projects to reduce anthropogenic greenhouse effects, such as the dispersion of aerosols in the atmosphere, are also considered. But since, as the author concedes, "it is always dangerous to fool around with mother nature", such actions might trigger unintended consequences that could transform dreams into nightmares (to be then shifted to the tiny fourth section of the book that bears this title).

Cyclopean's plans to harvest solar energy in outer space with an armada of satellites and eventually send it to Earth via microwave radiation, using immense transmitters and receivers, are described as "feasible". Likewise, the extrema ratio of making Mars habitable, so that one day humanity could escape from a messy planet Earth, is seriously considered ("a dream but not an impossible one"). The extent of the problems to be overcome and the economic and energy investments required for these unlikely endeavors are just immeasurable. This part, therefore, looks more like an indulgence to the author's space engineering background than a rational possibility.

After all, we already have some pretty demanding, but definitely more realistic, options for starting to walk our long way out of the fossil-fuel era.



Energy Demand and Climate Change
Issues and Resolutions. By Franklin Hadley Cocks. Wiley-VCH, Weinheim 2009. 251 S., softcover, € 24.90.—ISBN 978-3527324460

For example, to meet the total demand for electricity in the European Union with existing and still-evolving photovoltaic technologies, about 0.6% of the territory of the EU would need to be exploited for solar-energy harvesting. If instead we were to aim to supply a more modest 5% of the electricity demand, it is not difficult to conclude that we could start our energy transition here and now, without waiting for futuristic science-fiction advances.

The solution to our energy problems is rooted down here on Earth, and it is not only technological: it begins with alleviating the energy disparity between the two billion energy-overfed people and a much greater number of energy-starved and underprivileged people. Scientists must play a role by explaining to the politicians and the general public the choices that must be made, and which options must be avoided. Resources are limited and time is short—we cannot try anything and everything to avert our impending energy and climate Armageddon.

Despite a few drawbacks, not least insufficient bibliographic section, this book is a practical and rationally arranged guide through the labyrinth of energy options, with an original climatic and astronomical perspective. It is recommended to graduate students and to science educators at all levels, who have the pressing responsibility to increase awareness of energy and climate problems in younger generations.

Nicola Armaroli
Istituto per la Sintesi Organica e la Fotoreattività
Consiglio Nazionale delle Ricerche, Bologna (Italy)

DOI: 10.1002/anie.200904516

