Book review

Energy and Carbon Emissions: The Way We Live

Nicola Terry. UIT, Cambridge, UK, 2011, ISBN 978 1 90686 014 1, £9.99, 256 pp.

Nicola Terry has produced a fascinating and topical compendium of energy end-use data and coupled greenhouse gas (GHG) emissions. It contains a wealth of information and associated graphs and tables, aimed at giving the non-specialist reader – householders, the consumers of food, goods and services, and personal transport users – an understanding of how we employ different energy sources and their potential implications for climate change. She comes to this with a background in computer science and engineering and then environmental studies, as well as a current base as a surveyor for Cambridge Carbon Footprint's 'climate friendly homes' project. In addition, she is an active member of the Transition Cambridge Energy Group. The latter is part of the vibrant Transition Towns movement, initiated by Rob Hopkins and others in Totnes, which seeks to ensure local resilience and mitigate climate change by limiting our use of fossil fuels, particularly oil, in the face of 'peak oil' – the depletion of worldwide reserves of this important energy resource. However, a number of natural scientists (such as Kjell Aleklett and co-workers at Uppsala University in Sweden) believe that this is rather misconceived. There is, they contest, too little oil, natural gas and coal available for anthropogenic global warming to take place on anything like the scale implied by the scenarios produced by the Intergovernmental Panel on Climate Change. However, that should not stop us all from taking steps to mitigate further climate change.

Terry starts by addressing the basics of global climate change and then the overall UK energy situation. Throughout the book, data on energy are typically given in units of kWh/person-days; no doubt influenced by the approach taken in David MacKay's book *Sustainable Energy – Without the Hot Air* published in the same series. Associated GHG emissions are represented here in terms of carbon dioxide equivalents (CO_2e) – the basket of GHGs converted on an equivalence basis in terms of their differing 'global warming potentials' with units of gCO_2e per functional unit (e.g. person-days, kg of material or product, kWh of energy used, passenger-km travelled, or tonne-km of freight journey). Data are taken from a variety of usually reliable sources for the late 'noughties', often 2007–2008. Terry makes clear the inevitable uncertainties in the statistical sources available. She argues (along with others) that the longer humanity waits to tackle climate change, the more dramatic will be the required rate of GHG reductions in order to keep the global temperature rise to less than 2°C , the figure that many climate scientists believe is needed to limit damaging global warming. The potential for energy and GHG savings is presented across the end-uses of most importance to the broad community. There is quite an emphasis on energy saving in the home, based around what Terry describes as a 'rough and ready' approach to energy analysis and GHG accounting of dwellings. She illustrates the options by considering two archetypical houses, which she characterises as the 'cosy house' and the 'leaky house'. The performance of these dwellings is contrasted with that of – for example, the UK Zero Carbon Homes standard and the German PassivHaus requirements.

It is a pity that Terry does not introduce the reader to the fundamental differences between the quantity and quality of various energy carriers: reflected in the thermodynamic properties enthalpy and exergy, respectively. She argues that making a distinction between low grade

heating and electricity for power applications (undertaking 'work') is perhaps too complicated for the general reader. It is certainly important that the thermodynamics of our energy system are properly understood, particularly by decision makers of different sorts: in central and local government, building designers, property developers and those in the energy utilities. An awareness of the distinction will also help energy end-users to be more active citizens in the energy domain. Energy analysis, stemming from the first law of thermodynamics, provides an appreciation of the need for energy conservation. On the other hand, exergy analysis (which is derived from the first and second laws) highlights the importance of energy or heat cascading. High grade energy sources, such as electricity, thus need to be primarily employed for power applications (such as lighting and appliances), rather than space or water heating. It is true, as Terry makes clear, that in a fully decarbonised energy system (based largely on a combination of fossil fuel power stations with carbon capture and storage, renewable energy technologies (principally wind and solar thermal (hot water) and photovoltaic systems), and possibly nuclear power) energy and exergy considerations are less important. Nevertheless, the UK is very far away from having a low, near-zero carbon energy system.

Nicola Terry tries to steer the reader through the answers to a variety of questions that might exercise the potential climate-sensitive citizen. Is it still worthwhile putting up solar panels if a householder's roof faces south-east? Yes. Anywhere between a south-east and south-west orientation is reasonable as the solar energy incident on a UK roof is not critical to the output within this range. There is a useful associated chapter on renewable energy that focuses on wind, solar (hot water heaters and photovoltaic arrays), marine (tidal barrage, tidal stream and wave) energy converters, and waste minimisation. These technologies are contrasted with conventional heat and power systems. The text also introduces the concepts of the energy gain (termed here 'payback') ratio and life-cycle GHG emissions. Should a car owner scrap their old vehicle and buy a new one? It turns out that one has to drive 58 000 km before offsetting the embodied carbon dioxide emissions from a new Prius Hybrid. In order to guide the interested reader around these technicalities, Terry has a chapter on the resource efficiency of products. She appears to use embodied energy and carbon data mainly from the Inventory of Carbon and Energy developed at the University of Bath. How much carbon will people save if they stop eating meat? Terry suggests typically three-quarters of the gCO_2e per gram of protein. There is a very good chapter on land use and agriculture that describes the UK and world sources of GHG emissions due to agricultural and forestry activities. However, it is a little unclear how the non-specialist would use this information to good effect in their everyday life.

The book finishes with a chapter giving world energy use and GHG emissions data. This places the situation in the UK in its global context. Britain ranks around the highest in terms of cumulative or historic GHG emissions, because our industrial revolution started early and was largely based on 'dirty' coal. China and India, although their emerging economies are becoming major annual carbon dioxide emitters, still fall significantly behind the USA and the EU in terms of total historic emissions. Overall, this is, therefore, an important and useful book. It will provide helpful advice, to the many community groups that are springing up around the UK with the aim of reducing personal carbon dioxide or GHG emissions. Nicola Terry is to be commended on producing a stimulating array of data and associated guidance for the active citizen in our climate constrained world.

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