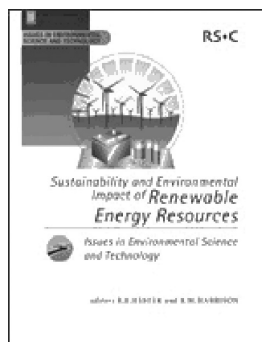


Energy, Technology, Politics

James Manwell*



Sustainability and Environmental Impact of Renewable Energy Resources

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Sustainability and Environmental Impact of Renewable Energy Resources is one of the series 'Issues in Environmental Science and Technology'. The intention of the series is to publish articles that offer a critical analysis of the methods that are currently used for the appraisal of sustainability of the various energy options. The present book comprises seven chapters, covering the topics from the role of renewable energy in future energy supply, through an overview of some of the technology options to a discussion of policy and incentives.

The first chapter, by Bernard Bulkin of British Petroleum, provides a broad overview of the future of today's energy resources, primarily focusing on the fossil fuels. The chapter summarizes the use of fossil fuels in various sectors (transportation, power generation, etc), discusses the reserves of fossil fuels, reviews some of the expected trends towards greater efficiency, and then considers carbon sequestration in some detail. This chapter does not discuss renewable energy sources in any depth, but it does provide a useful backdrop. In particular, Bulkin notes that while oil and natural gas reserves are quite limited (about 40 years at current consumption), coal could last longer (200 years) but the resulting carbon dioxide appears rather problematic.

The second chapter, by David Eliot of the Open University, examines the choices, problems, and opportunities of renewable energy sources. The impetus for use of renewable energy, as Eliot sees it, is dealing with climate change. Substantial reduction of carbon dioxide generation below current levels is called for. Possible ways to accomplish such reductions include carbon sequestration, increased efficiencies in energy generation and end-use, nuclear power, and renewable energy. Eliot is not very optimistic about sequestration. Efficiency improvements can still be made in generation but there are clear limits; where possible, combined heat and power (CHP) is seen as one of the easiest ways to improve overall efficiency. Switching from coal to gas results in improvements as well, but the limited supply of gas reserves becomes more serious. End-use efficiency improvements can also be useful but, with increasing population, the primary goal will be to lower the

rate of increase of CO₂ rather than to actually decrease it. Nuclear power is seen to provide one possible avenue to CO₂ reduction but many of the issues (fuel supply, waste storage, capital costs, public acceptance, safety, etc) have not been resolved. The most promising option is energy from renewable sources. Eliot then goes on to provide a useful overview of renewable resources, the progress made with many of the technologies, the significant costs of renewable energy, and the environmental impacts associated with large-scale deployment of renewable resource based generation.

The third chapter, by David Infield and Paul Rowley both of Loughborough University, provides a broad overview of renewable energy technology and the issues associated with integrating this into the utility system. There are four principal sources options, wind, direct solar, water, and biomass, and this article focusses on the first two with a brief synopsis of the second two. Both wind and solar sources are variable with time and cannot be dispatched. These characteristics significantly affect the operation of an electrical network and the authors appropriately devote a number of pages to this issue.

Adrian Loening of Arbutus Renewables then offers a chapter on biomass energy, which is presently and will continue to be one of the principal sources of renewable energy. Biomass energy includes landfill gas, a source although not strictly 'renewable' will no doubt keep renewing itself as long as the human race continues to consume and then discard. One topic of particular interest is that of producing fluid fuels by using biomass material as a feedstock. There are numerous issues to be considered here, including the biomass supply and its energy content, transportation, undesired components, products of combustion, and economics.

Fiona Mullins of the Royal Institute for International Affairs writes next about emissions trading schemes. Such schemes are one now common approach to providing a monetary value to reducing levels of pollutants. By establishing allowable levels of pollutants, both as a whole and to individual polluters, if a polluter can lower the amount of pollutants released, the credits earned may be sold to another polluter who cannot make a reduction in pollutants. This approach provides the least-cost way to lower overall levels of pollutants. A counterargument is that there can be zones of higher pollution, which may have serious local impacts. More recently (although unfortunately not discussed in the chapter), the approach has also been adapted to encourage the use of renewable energy. Known as the renewable portfolio standard (RPS), this sets a minimum fraction the electricity supplier must produce from renewable sources, and establishes a credit system to facilitate attaining the corresponding levels. As with the emissions trading systems, there are debates regarding the fairness and effectiveness of the RPS approach.

In Chapter 6, Brian Wilson, Minister of Energy and Construction for the present British government describes the current British policy on renewable energy. This is essentially a version of the RPS approach mentioned above. The intent of the policy is to increase the fraction of electricity from renewable sources up to 10% of the total by 2010. Unfortunately, Wilson also goes out of his way to assert that he does not ‘want the countryside to be covered with wind turbines’, causing one to wonder just how the required level would be met, not to mention any future increases.

Finally in the last chapter, Andrew Stirling of the University of Sussex discusses the need to inform policy makers of the implications, both positive and negative of the various sustainability options. Broadly speaking, the choices fall into two categories, the ‘scientific’ and the ‘precautionary’. Due to the inherent difficulties associated with the scientific approach (which could lead one to a state of inaction due to uncertainty), the author recommends a broad-based precautionary approach. This would facilitate taking positive steps, and doing so in a manner that could be seen as reasonable.

Overall, this book is significant in that it brings together, in a single volume, assessments of energy issues from a range of vantage points. On the other hand, the book is also remarkable at what it leaves out. What is most notable is the lack of a synthesizing chapter by the editors. This would put the whole discussion in context and help the reader assess what the next steps should be. From the early chapters it can be seen that the options available for supplying energy to the world’s growing economies are really quite limited. Whether existing fuel reserves can last 50 or 200 years is of less concern than the observation that, in historical terms, they will be exhausted (or very expensive) in a very short time. In addition, the amount of greenhouse gases that are likely to be released due to the burning of the available fossil fuels could have

catastrophic effects on the world’s climate. What are the alternatives? Renewable energy sources are seen as the only viable option. The technology has certainly advanced over the last 30 years or so, but even integrating a relatively moderate amount into the existing utility networks can be a challenge. Local variability in the distribution of available fossil fuel resources throughout the world, although also not discussed in much detail, will almost certainly continue to have profound geopolitical implications. Also not discussed in any great detail are the adverse impacts of renewable energy generation—land use, visual, wildlife impacts. On the one hand, development of renewable energy resources appears to be necessary to ensure a decent future, but in practice it is extremely difficult to develop projects because of marginal economics as well as local impacts. Various mechanisms that could help improve the economics such as emissions trading and portfolio standards are discussed, but are they the most effective options to really spur development? For example, there is no mention of the German feed-in tariff incentive, which by all appearances is one of the most effective yet promulgated. One also wonders, how much energy can we really ultimately obtain from renewable energy sources? What would technology look like, and what would be the impacts on society? Will hydrogen play a role, and if so, how? It would seem that a call to action is appropriate if we are to have any hope at reaching a sustainable state of affairs without passing through a cataclysmic transition.

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