

Handbook of Alternative Fuel Technologies, S. Lee, J.G. Speight, S.K. Loyalka. CRC Press, Taylor & Francis Group, Boca Raton, FL (2007). 567 pp., Price: US \$149.95, ISBN: 978-0-8247-4069-6

My review of this book closely follows a review of a text on alcohol fuels. Both books examine the future of energy supplies and sustainability on our way of life. Needless to say, the topic is of immense importance and one that will be the basis for many more books on this topic.

In the Preface, the authors write:

“The unprecedented popularity and successful utilization of petroleum resources observed in the 20th century may have to decline in the 21st century owing to a lack of resource availability, thus making prospects for future sustainability seem grim. Public appetites for convenient fuel sources and superior high-performance materials are, however, growing. Therefore, additional and alternative sources for fuels and petrochemical feedstocks are not only to be developed further but are also needed for immediate commercial exploitation. Use of alternative fuels is no longer a matter for the future; it is a realistic issue of the present.

Additional and alternative sources for intermediate and final products, whether fuels or petrochemicals, directly contribute to the conservation of petroleum resources of the world by providing additional raw material options for generating the same products for consumers. Examples may include wood alcohol for methanol, corn fermentation for ethanol, biodiesel from soybean or algae, BTX (benzene, toluene, and xylenes) from coal, biogas or bioliquid from agricultural wastes, hydrogen as transportation fuel, bio-hydrogen from a variety of biological sources, jet fuel from shale oil or crop oil, Fischer-Tropsch fuel from coal or biomass, bisphenols from agricultural sources, liquid transportation fuels from a natural gas source by ZSM-type catalysis, ethylene/propylene via conversion of synthesis gas, use of coal-derived acetylene for petroleum-derived ethylene as a building block chemical, and liquid fuels from spent tires or mixed wastes, etc.”

The book's coverage is described by the authors in the Preface. I will repeat mainly what they state but with some paraphrasing:

- Chapter 1: Global energy overview—focuses on the current concerns regarding consumption of conventional energy sources. This discussion is followed by a review of the importance of further development and utilization of alternative renewable and clean energy sources. There is a great deal of information on the current and past consumption of conventional energy by energy and source and year.
- Chapter 2: Gasification of coal—deals with the science and technology of coal gasification to produce synthesis gas.
- Chapter 3: Clean liquid fuels from coal—discusses the science and technology of coal liquefaction for production of clean liquid fuels.
- Chapter 4: Coal slurry fuel—deals with the science and technology of coal slurry fuels.

- Chapter 5: Liquid fuels from natural gas—discusses liquid fuels obtained from natural gas.
- Chapter 6: Resids—contains a discussion of the science and technology of resids.
- Chapter 7: Liquid fuels from oil sand—describes the occurrence, production, and properties of oil sand bitumen and the methods used to convert that material to synthetic crude oil.
- Chapter 8: Shale oil from oil shale—explores the science and technology of oil shale utilization.
- Chapter 9: Methanol synthesis from syngas—focuses on the synthesis of methanol from gas.
- Chapter 10: Ethanol from corn—discusses the production of fuel ethanol from corn.
- Chapter 11: Ethanol from lignocellulosics—reviews the process steps and technological issues involved in the conversion of lignocellulosic materials into ethanol.
- Chapter 12: Energy from biomass conversion—deals with the process options for energy generation from biomass.
- Chapter 13: Energy generation from waste sources—discusses energy generation from waste materials.
- Chapter 14: Geothermal energy—describes the occurrence, renewability, and environmentally beneficial utilization of geothermal energy.
- Chapter 15: Nuclear energy—deals with the science and technology of nuclear energy.
- Chapter 16: Fuel cells—presents the basic concepts of fuel cells.

Chapter 13 deals with energy generation from waste sources. I was surprised, but delighted, to see that three major (waste) raw materials are discussed: (1) municipal solid waste, (2) polymeric waste and (3) spent tires.

Nuclear energy, its production and the public's concern regarding that, was the subject of a chapter by Loyalka. This chapter was well done, which is not surprising since the author is a professor of nuclear and chemical engineering. Nuclear energy used for fuel production is currently receiving much positive attention because the process produces no carbon dioxide emissions.

The authors state their purpose in writing this book was to present comprehensive information regarding the science and technology of alternative fuels and their processing technologies with special emphasis being placed on environmental and socioeconomic issues associated with the use of alternative energy sources, such as sustainability, applicable technologies, mode of utilization, and impacts on society. In my opinion, they have done this very well.

The authors note that the book would be suitable for a three credit hour course entitled: “Alternative Fuels,” “Renewable Energy,” or “Fuel Processing.” Indeed, it would although inclusion of student assignments would have been a beneficial aspect for textbook adoption.

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Renewable Resources and Renewable Energy: A Global Challenge, M. Graziani, P. Fornasiero (Eds.). CRC Press/Taylor & Francis Group, Boca Raton, FL (2007). 380 pp. Price: USD \$129.95, ISBN: 978-0-8493-9689-2

The popular press has articles daily discussing global warming and the cause thereof, carbon dioxide emissions. Calls reverberate for reduction in carbon dioxide generation. While that may be useful, I think that is a side issue. Sustainability, in my opinion, is the more important topic. Consequently, if carbon dioxide generation is reduced by using less fossil fuel in power generation by using renewable technology, we would attack the global warming problem directly. Otherwise we lose, as given the worldwide demand for power, fossil fuels which contain carbon will continue to be the basis of that power – or at least until they run out. This book, as the title suggests, discusses that problem, that is, renewability.

Written by 42 contributors from 12 countries (with Europe dominating), the authors present technical data on the world's potential sources of sustainable fuels which topic they note is "urgent."

Ethanol is currently the fuel being discussed at length. It is interesting, because as a liquid, it mimics gasoline as a "mobile" fuel. Moreover, it can be produced from biomass of which only 7% of the 155 billion tons produced worldwide annually are utilized. Ethanol and other renewal resource products are discussed in the book's first section whose chapter titles are noted below:

Part I: Technologies for Application and Utilization of Renewable Resources:

1. rationale, drivers, standards, and technology for biobased materials;
2. biobased key molecules as chemical feedstocks;
3. industrial chemistry with nature-based bioprocesses;
4. catalytic conversion of carbohydrates to oxygenates.

Section II focuses on plastics. The first chapter notes that: "more than 98% of plastics are based on fossil feedstocks (crude oil), the reserves of which are predicted to last for only approximately 80 more years." Currently, we consume 30 kg of oil per capita worldwide with 80–100 kg being utilized in industrialized countries. In the chapters (titles shown below), the authors describe in much detail processes for plastics production of a variety of processes.

Part II: Plastics and Materials from Renewable Resources:

5. developments and future trends for environmentally degradable plastics;
6. production of plastics from waste derived from agro food industry;
7. on the environmental performance of biobased energy, fuels, and materials: a comparative analysis of life-cycle assessment studies.

The second major "renewable" fuel currently garnering much attention is hydrogen. It is a "clean" fuel that is noted in one chapter as "the energy source of the future." The same author notes that hydrogen is the most plentiful element in the universe making up to 75% of the mass of all visible matter in stars and galaxies. Currently much of the hydrogen produced comes from oil-based processes, but it could be produced biologically or by electrolysis of water – a process being studied on behalf of nuclear power plants. One nuclear power plant I know in Canada is looking for ways to use its excess power in times of low demand to produce hydrogen. This section of the book contains the following material:

Part III: Technologies for Renewable Energy:

8. hydrogen production and cleaning from renewable feedstock;
9. gasification of biomass to produce hydrogen;
10. sustainable biological hydrogen production;
11. hydrogen-based technologies for mobile applications;
12. efficiently distributed power supply with molten carbonate fuel cells.

The final section of the book looks at technical advances in developing countries as noted below:

Part IV: Trends, Needs, and Opportunities in Developing Countries:

13. renewable resources and energy in the Asia Pacific region;
14. development of renewable energy in Malaysia;
15. outlook on catalytic technologies for sustainable development: the Argentina case;
16. marketing photovoltaic technologies in developing countries.

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