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# BOOK REVIEW

HANDBOOK OF ENERGY SYSTEMS ENGINEERING—PRODUCTION & UTILIZATION, Leslie C. Wilbur (ed.), Wiley–Interscience, 1985. Price £76.70. No. of pages: 1792.

Energy systems can embrace a wide range of recognizable disciplines—geography of location and geology of formation of fossil fuels; mining and mineral technologies of fuel recovery; chemical and process engineering of primary conversion; mechanical and electrical engineering for secondary conversion etc., and we have not spoken about nuclear energy, the renewable resources or problems associated with energy utilization. All of these topics are linked, as for all engineering, through the economics of financial planning and performance assessment—the micro-economics of the relative costs and availability of competing fuels, at the company scale, and the macro-economics of pricing policies and fuel availability, at the natural scale. Recent events have shown that energy resources are even used as weapons in international politics, as in the rapid price escalation following the oil crises of 1973 and 1981. There is considerable evidence to suggest that the current economic slump in manufacturing industry is largely attributable to these crises.

But, particularly for the end user, energy is not a simple commodity of trade to be measured in monetary terms. Energy forms are largely interchangeable in application; they have different price structures; they involve different technologies. Electrically can be used, like oil or gas, to heat material in a furnace but with different efficiencies, capital costs and recurring costs. The energy systems engineer, particularly at the utilization end, must have a wide range of skills at his disposal. It is easy to say what reference material must be covered for an energy engineer, it requires much more discernment to say what could be omitted.

Presumably an energy engineering handbook must reference the necessary range of skills for the user in such a way that he can familiarize himself with the basic ideas and know when and how to find more detailed information. The test for this book is whether it achieves this satisfactorily.

Scanning the chapter headings shows that it covers a wide range of material and it is easy to see that the coverage is excellent, with good presentation of basic principles and adequate references for further work—demographics of energy demand, resources (including renewables), production etc., optimization of energy use, conservation, targeting and monitoring, cogeneration, energy utilization laws and principles, thermodynamics, fluid mechanics, heat transfer, energy system technology, pumps, fans, heat exchanges—all are here.

But wait! An example—suppose we wanted to move fluid with a fan (characteristics are given in the book), how do we choose the prime mover? It would probably be an electric motor but how do we specify it? We would get an improvement in energy performance by running at variable speed, but can we design a suitable electric drive? The electrical engineering applications of energy utilization have been completely overlooked. True, generation has been adequately covered but few energy engineers will be involved with generation unless they are specialists working for the generating utilities or are involved with CHP (or cogeneration). Most energy engineers would need information on power electronics, inverter drives for variable speed induction motors, electrical resistance, induction and dielectric heating, perhaps even power factor correction. These fields of growing importance in energy utilization do not even rate a mention in this book. Perhaps I am being unfair. What about electricity for space heating in the home? Yes, this is covered in as many pages a coal and gas fired furnaces but storage heaters or differential tariffs are not mentioned. I am sure that the U.K. electricity boards would not be pleased to see a book purporting to be a handbook of energy utilization omitting these topics!

To be fair, the technology which is covered receives, in most cases, first class treatment—heat engines, nuclear power, heat exchangers—and this also applies to the renewables—solar (although some description of the heat transfer in a plate collector would have been desirable), wind, biomass. Little of this could be excluded or given a lighter treatment. It is therefore incumbent upon me, in view of my statement of being discerning over what is left out, to suggest how the book could have been improved in the same number of pages. What can be omitted? What should have been included, or given better treatment?

About 40 pages of the book are used to cover controls and instrumentation. Control is as important in an energy system as in any other engineering system but it is not more important; 'it uses no techniques which are peculiar to energy; it is a specialized topic and much harm can be done by the non-specialist.

About 120 pages are devoted to engineering

mathematics. All very good material and well presented, but this book would not displace a mathematics reference book and none of the mathematics is peculiar to energy.

To these 160 pages perhaps we could add a few pages, such as those devoted to rocket engines, on the grounds that this is specialist aeronautical (or astronautical) engineering.

What is missing? Apart from a major chapter on electricity utilization there are at least three other topics which need better treatment.

Combustion of fuels is very sketchy (12 pages on coal, 5 on oil, 6 on gas) with little mention of general combustion equations.

Pollution from energy use (as distinct from production) is poorly treated. 'Acid rain' is not listed in the index, $SO_x$ and $NO_x$ emissions receive little general treatment and, although the chemistry of limestone absorption of $SO_2$ in coal furnaces is covered, the costs and legal implications are barely mentioned.

The process industries with some of their particular areas of utilization are hardly mentioned. Energy intensive processes (such as evaporation, distillation, heat treatment), the use of steam for process heating and process integration are all valuable topics for a handbook under this title.

One last complaint—why in a modern reference book does one still see an emphasis on feet, pounds, BThU etc. with S.I. units only introduced by conversion factor?

If the reader is concerned with the technology of power production from primary sources (including renewables) this is an excellent and valuable handbook dealing with most aspects. It is, however, not a book for people concerned with energy utilization, there are too many topics missing. Utilization should have been omitted from the title, which is a pity because those working in energy utilization have far more need for a general handbook than the specialists working in power production.

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