



## Solar Heating and Cooling

### Active and Passive Design

J. F. Kreider and F. Kreith

In the 1980s the utilisation of solar energy has reached the state of maturity in which the leading early books on the subject have begun to appear in second editions. Kreider and Kreith have been prolific writers on the subject and the first edition of *Solar Heating and Cooling* was quite widely known. The new edition follows the rationale of the original closely: detailed theoretical work is omitted and the emphasis is on simple design rules and practical advice for system designers and installers.

The topics covered still include the main thermal applications of solar energy: heating of domestic hot water and living space, and space cooling. Reacting to experience with these, the authors have introduced new topics and changed the emphasis on others. For instance, the world-wide realisation that cost-effective active solar space heating is hard to achieve has redirected attention to passive heating measures, in which the architectural features of the building itself are used to provide collection and storage of solar energy. The procedure recommended for design purposes here is a derivative of the Solar Load Ratio method developed at the Los Alamos Scientific Laboratory. The treatment is typical of that used for other solar technologies throughout the book. As far as possible, design procedures are reduced to the selection of the leading particulars of the building and the site, using the given tables of typical values where primary data are not to hand, followed by reference to charts and diagrams to obtain performance estimates, optimum system parameters and so on.

A chapter on economic evaluation provides the basis for cost-effectiveness calculations. The same general form is used for solar hot water heating and swimming pool systems and for active space heating and cooling, using methods that are, more-or-less, generally recognised. Some special topics are included because they are perceived to have growing importance: photovoltaic energy systems and solar ponds (understandably enough) and wood stove systems (which seem to be somewhat alien in this company). Design chart methods are applied to these topics also, although the theoretical basis is not so well established and practical experience with real systems much less.

Such a handy design guide, addressing the outline sizing of systems for a given duty, could be invaluable at a stage when alternative systems are being evaluated. There are, of course, some obvious risks when procedures are used which are reduced to the point where the theoretical basis and in-built

assumptions are totally obscured. References to the primary sources are given here, so that the prudent user can follow up the theoretical development, but confidence in design procedures rests also in the degree to which they have been validated in the measured performance of real systems in service, and this is less easily checked. Limitations on the range of applicability of procedures are also difficult to assess. There is bound to be interest in this book among system designers in northern Europe and Canada, where the latitudes go beyond those for which most of the procedures have been developed, and some uncertainty about their applicability must remain.

The strong US bias of this text is understandable but regrettable. Many procedures involve climate-dependent factors and numerous tables of these are included, covering locations throughout the continental United States; users concerned with other locations will be uncertain how to derive suitable factors for their own sites. A whole 40-page chapter is devoted to solar legislation in the various states; interesting reading, but not applicable outside the US. A recurring irritation concerns the units employed. The transition in the US from the former British units to SI is being extraordinarily long-drawn-out and painful. Here the majority of quantities are in British units and hidden factors in many of the design procedures mean that they may only be used in those units. Developments in the rest of the world are forcing SI quantities in to the US scene, but in the transition period authors are employing clumsy mixtures of units which can be confusing. Where units are suppressed altogether, as in the U and R values for insulation quoted in this book, there is a real risk of miscalculation.

These criticisms apart, the book should find a place in many design offices, even outside the US, and may be particularly welcomed for the wealth of practical detail that has been included. As in the first edition, the authors warn of the rapid pace of development in solar technology and of the need for designers to keep up to date. Maybe this will lead in time to the appearance of an even more comprehensive 3rd edition—in SI next time?

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