

Preface

The present book attempts to describe various forms of solar energy conversion techniques in a unified way. The physical framework used to describe the various conversions is endoreversible thermodynamics, a subset of irreversible thermodynamics. It thus studies situations which are not in equilibrium and in which therefore entropy is continuously created. Nevertheless the mathematics is simple, because we consider only stationary situations, i.e., we are not concerned with transient phenomena, oscillations or any the like.

Most undergraduate textbooks on thermodynamics emphasize equilibrium thermodynamics and reversible processes. No entropy is created and conversion efficiencies are maximal: equal to the Carnot efficiency. For irreversible conversion processes, the reader learns only that entropy production is positive and that conversion efficiency is lower than the Carnot efficiency. But how great the entropy creation is, and how low the efficiency, is usually not expressed. Endoreversible thermodynamics give us the opportunity to calculate explicit values for a broad class of processes. It is demonstrated in the text that solar energy conversion is a process particularly suited to being described in this way.

The book does not aim at completeness: it neither describes all conversion processes nor gives a complete state-of-the-art description of the technology. On the contrary, it illustrates general principles by idealized models. Technological examples are presented only to compare reality with theory.

Solar energy specialists will recognize their everyday technology, placed in a general framework. Nonspecialists will discover a wide overview of solar energy conversion.

The language of the book is fairly mathematical. However, the mathematical knowledge of anyone, who has followed at least two years of a course on mathematics, physics, or chemistry at university level, should amply suffice in order to follow the calculations. The book does not contain a single differential equation! Also, the physics background needed is of undergraduate level. I therefore hope the book will appeal to a broad public. However, the reader

should be familiar with SI units, which are used throughout the book (except for the electronvolt and for some rare appearances of the degree centigrade).

Sometimes the physics (or sometimes the mathematics) background is more deeply explored. Such sections can be skipped by readers who are interested only in pure solar energy results. *Gourmet* readers will enjoy excursions in the sections, labeled with the symbol ♡.

In 1992, a first version of the book was published by Oxford University Press, under the title “Endoreversible thermodynamics of solar energy conversion.” The present book distinguishes itself from the former one, in the following respects:

- minor errors in text and figures have been corrected;
- details in text and figures have been updated;
- to each chapter exercises have been added;
- one section (i.e., Section 8.5) has been added;
- poor Pluto is deleted from the list of planets.

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