
Preface

It is just a matter of time before fossil fuels become completely depleted or too uneconomical to retrieve. In light of this development, the current fossil fuel era is meant to draw to an end. If on top of this problem of diminishing availability we also add the environmental pollutions the fuels have caused, it is understandable why we must soon find ways to end the current period and enter a new energy era.

Hydrogen is regarded as one of the most promising candidates capable of assuming a leading role during this historical transition. Needless to say, the energy needed to obtain hydrogen cannot be provided by fossil fuels. It is therefore necessary to turn to renewable energy sources which are inexhaustible and cause as little environmental impact as possible. Amongst these sources, the authors consider solar energy to be one of the best choices for reasons that will be elaborated in the following of the book.

The work is structured into eleven chapters to present the readers with advanced knowledge on the functioning and the implementation of a solar hydrogen energy system, which combines different technologies efficiently and harmoniously to convert renewable energies into chemical energy stored in the form of hydrogen and then to a much more exploitable form of energy, electricity.

Chapter 1 introduces the macro-economical, technical and historical aspects of the new hydrogen-based energy system. Chapter 2 describes the physical and chemical properties of hydrogen, its production, application, the degenerative phenomena and the compatibility of the materials employed to handle hydrogen storage and transportation. Chapter 3 explores in detail the behaviour and the modelling of electrolyzers and fuel cells. Chapters 4 and 5 describe the technical foundations of photovoltaic and wind energies. Chapter 6 discusses other potential renewable energy sources for hydrogen production. Chapter 7 addresses another important issue of the whole process: the storage of hydrogen. Chapter 8 provides more information on the chemical storage in standard batteries and other more advanced alternatives. Chapter 9 finally examines in detail the actual complete implementation of the hydrogen system and simulates the system behaviour with the help of mathematical models. Chapter 10 proceeds to present some of the most interesting real-life applications, while Chapter 11 draws the final conclusions. At the end of every chapter are listed the relevant references for readers who wish to further explore the topics.

This book has been conceived with the goal to share the science and technology of solar hydrogen energy systems and to help building a new sustainable energy economy. We hope that we will succeed.

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*Gabriele Zini
Paolo Tartarini*

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Zini, G.; Tartarini, P.

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