LARGE-SCALE SOLAR POWER SYSTEMS

This book is a comprehensive discussion and economic analysis of large-scale solar power systems, specifically referencing critical issues related to design construction and financing. The book provides practical design, installation, and financing guidelines for large-scale commercial and industrial solar power projects. Engineering design and construction methodologies as well as economic analysis provide a step-by-step walk-through of all aspects of solar power systems. Design methodologies outline the specific requirements of solar and electrical design and construction documentation in meticulous detail, which can readily be applied to ground mount, roof mount, building integrated (BIPV), and carport-type solar power projects. In view of the importance of solar power systems as a viable present and future energy resource, the book includes a dedicated chapter on smart grid transmission and large-scale energy storage systems.

Dr. Peter Gevorkian is President of Vector Delta Design Group, Inc., an international electrical engineering and solar power consultancy, and CEO of Solar Analytic Solutions, Inc., an engineering R & D organization. He has designed more than 50 MW of photovoltaic systems for health care, aviation, and regional utility companies and holds numerous patents. Dr. Gevorkian has also developed advanced econometric analytical software for large-scale solar power design and financing. Dr. Gevorkian is an active member of the Canadian and California Professional Engineers and California Society of Energy Engineers.

Over his 40-year career, Dr. Gevorkian has received numerous honors and awards including the AIA 2007 Engineering Merit Award for Renewable Energy Systems and Exceptional Contribution to the Advancement of Solar Power Co-generation in Building Design, the AIA 2007 Design Honor Award for Outstanding Engineering Design for the Metropolitan Water District's Museum of Water & Life, the AIA 2008 Honor Award for Outstanding Design Achievement in Solar Power Engineering, and the AIA 2009 Honor Award for Excellence in Solar Power Design.

Dr. Gevorkian is the author of numerous technical papers and technical books on renewable energy systems design. His books include *Sustainable Energy Systems in Architectural Design, Sustainable Energy System Engineering, Solar Power Systems in Building Design, Alternative Energy Systems in Building Design, Large Scale Solar Photovoltaic System Design,* and *Large Scale Solar Power Construction & Economics.*

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Peter Gevorkian, *Large-Scale Solar Power Systems: Construction and Economics*

Large-Scale Solar Power Systems

Construction and Economics

Peter Gevorkian

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Preface

In the past decade, deployment of solar power systems has been misunderstood and hampered mainly by lack of appreciation of the technology, as well as by skeptics who without knowledge of solar power system technology and its economics have flooded the media with opinions that are inaccurate and misrepresentative regarding significant benefits of the technology in terms of its significant impact on global warming and its inevitable future economic significance.

In previously published books, I have discussed implications of global dependency on fossil fuel use and the consequences of global warming, which due to the topics' significance, are once more been discussed in this book.

About This Book

During years of practice as a research and design engineer, I have come to realize that some of the greatest obstacles hindering accelerated development of the US solar power industry can be attributed to several factors. First and foremost, even though in the past decade the solar power industry has been advancing at an accelerated rate, higher educational institutions and more specifically engineering studies have not kept up with the solar power system technologies. It is noteworthy to recognize that solar power technology, unlike classical engineering, is not compartmentalized as a singular discipline such as structural, mechanical, or electrical disciplines; rather, it is a symbiosis of multiple disciplines that necessitate fundamental understanding of the principles of several engineering fundamentals that range from environmental studies, soils and civil engineering, electrical and electronics engineering, several fundamental understanding of physical principles of material sciences, optics, and engineering economics.

At present there are no higher learning institutions in the United States that offer a complete four- or five-year curriculum in Solar Power and Alternative Energy Systems Engineering specifically tailored to encompass all sciences and disciplines referenced earlier.

Furthermore, it should be noted that large-scale solar power technology deployment entails significant sums of investment; in order to appreciate and justify the validity of solar power system financial transactions, banking and financial lending institutions also need a fundamental understanding of solar power system technologies which unlike conventional investment associated with capital equipment loans or financing may offer a uniquely positive perspective regarding return on investment which otherwise could be ignored and dismissed as high risk financial transactions.

Therefore in the author's opinion the best way to promote the use of solar power as a sustainable energy design is through proper education of key professionals, such as architects, engineers, banking and investment personnel, and program managers whose opinions always affect project financing and development.

Furthermore, in two earlier books, "*Sustainable Energy Systems in Architectural Design*" and "*Sustainable Energy Systems Engineering,*" I attempted to introduce architects, engineers, and scientists to a number of prevailing renewable energy

technologies and their practical use, in the hopes that a measure of familiarity and understanding would encourage their deployment.

This book has been specifically written to serve as a pragmatic resource for solar photovoltaic power system financing. When writing the manuscript, I attempted to minimize unnecessary mathematics and related theoretical photovoltaic physics, by only covering real-life, straightforward design methodologies are commonly practiced in the industry.

As scientists, engineers, and architects, as well as finance professionals and economists, we have throughout the last few centuries been responsible for the elevation of human living standards and contributed to the advancement of technology while ignoring the devastating side effects to the global ecology. In the process of creating betterment and comforts of life, we have tapped into the most precious nonrenewable energy resources, miraculously created over the life span of our planet, and have been misusing them in a wasteful manner to satisfy our most rudimentary energy needs.

It should also be noted that, before it is too late, as responsible citizens of our global village, it is high time that we assume individual and collective responsibility for resolving today's environmental issues and ensuring that future life on earth will continue to exist as nature intended.

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