

Solar Energy Pocket Reference Energy Pocket Reference Series

The use of energy is being shaped by environmental issues including the fear of global warming. This has resulted in the development of renewable energy sources and more efficient building technology. Examining trends in energy efficiency, this book explores energy technologies and fuels, their prospects in a world with greenhouse gas restrictions. It looks at the technical and economic tradeoffs of traditional renewables such as wind and solar, as well as large scale PV and concentrated thermal power. It also considers biomass technologies. For each of these technologies, it discusses planning, siting, installation, operation and maintenance, health and safety, power conditioning, and efficiency innovations.

This handy pocket reference contains a wealth of information on a range of topics including the principles of passive solar building and passive house, a ten-step design and build strategy, calculating solar irradiance, factors affecting the choice of building materials, passive heating and cooling principles and techniques in different climates, the Passivhaus Standard and natural and augmented lighting and notes on technology and building occupation. The book also includes conversion factors, standards, resources and is peppered throughout with helpful illustrations, equations, explanations, and links to further online resources. Ideal for practitioners, architects, designers, consultants, planners, home builders, students and academics, and those working in development contexts, the book is intended to act as an aide memoir, a reference supplement, a resource and an overview of the field. Rich in background detail, the book also includes at-a-glance tables and diagrams, equations and key definitions.

Our pocket reference books provide a wealth of practical information at your fingertips, whenever you need it. Rich in background detail, at-a-glance tables and diagrams, equations, and more, the Passive Solar Architecture Pocket Reference is a handy resource for architects, engineers and students. Coverage includes: - Definitions - Load determinants and Responses (including world wide biomes and climates, building metabolism and response, thermal sources and sinks, passive building responses to sources and sinks, tuning the building to the environment, optimizing insulation & thermal mass for comfort) - Contextual Aspects (including microclimate and siting, temperatures, humidity, wind, radiation and comfort parameters - Passive Components (including building envelope, passive solar terminology, orientation, apertures and glazing, thermal storage, thermal control and materials - Design Tools (including sun path diagrams, sun peg diagrams, air flow relationships, thermal modelling and life cycle design - Specific Functions (including passive heating, passive cooling and ventilation, natural lighting, passive water heating, resource collection and Integrated design).

Combining the latest scientific advances with storytelling skills unmatched in the cosmos, an award-winning astrophysicist and popular writer leads us on a tour of some of the greatest mysteries of our universe. In the constellation of Eridanus there lurks a cosmic mystery: It's as if something has taken a huge bite out of the universe. But what is the culprit? The hole in the universe is just one of many puzzles keeping cosmologists busy. Supermassive black holes, bubbles of nothingness gobbling up space, monster universes swallowing others—these and many other bizarre ideas are being pursued by scientists. Due to breathtaking progress in astronomy, the history of our universe is now better understood than the history of our own planet. But these advances have uncovered some startling riddles. In this electrifying new book, renowned cosmologist and author Paul Davies lucidly explains what we know about the cosmos and its enigmas, exploring the tantalizing—and sometimes terrifying—possibilities that lie before us. As Davies guides us through the audacious research offering mind-

bending solutions to these and other mysteries, he leads us up to the greatest outstanding conundrum of all: Why does the universe even exist in the first place? And how did a system of mindless, purposeless particles manage to bring forth conscious, thinking beings? Filled with wit and wonder, *What's Eating the Universe?* is a dazzling tour of cosmic questions, sure to entertain, enchant, and inspire us all.

This book presents the latest developments and advances in solar desalination technology, including the concept, design, testing, modeling, economics and innovation. The chapters in this volume are contributed by leading international researchers and are based on original research material. The contents of this volume will be of interest to researchers, professionals, and policymakers alike.

Solar Energy in Buildings presents solar radiation fundamentals and their applications in buildings, supported by theoretical analysis and results of original simulation studies in solar energy availability, collection, and conversion for both active and passive use. In-depth coverage of energy balance and heat transfer in building envelopes is supported by the inclusion of calculations and case studies, while contextualizing within an integrated design approach. Explains the best uses of cutting-edge advances such as concentrated solar thermal, thermoelectric and polymeric materials Covers active and passive solar collection and conversion systems Provides energy balance calculations and case studies deriving from real installations connect theory and practice

Covers different categories of green technologies (e.g. biofuels, renewable energy sources, phytoremediation etc.,) in a nutshell -Focuses on next generation technologies which will help to attain the sustainable development -The chapters widely cover for students, faculties and researchers in the scientific arena of Environmentalists, Agriculturalists, Engineers and Policy Makers The World Environment Day 2012 is prepared to embrace green economy. The theme for 2012 encompasses various aspects of human living, ranging from transport to energy to food to sustainable livelihood. Green technology, an eco-friendly clean technology contributes to sustainable development to conserve the natural resources and environment which will meet the demands of the present and future generations. The proposed book mainly focuses on renewable energy sources, organic farming practices, phyto/bioremediation of contaminants, biofuels, green buildings and green chemistry. All of these eco-friendly technologies will help to reduce the amount of waste and pollution and enhance the nation's economic growth in a sustainable manner. This book is aimed to provide an integrated approach to sustainable environment and it will be of interest not only to environmentalists but also to agriculturists, soil scientists and bridge the gap between the scientists and policy-makers.

This second edition of *Principles of Solar Engineering* covers the latest developments in a broad range of topics of interest to students and professionals interested in solar energy applications. With the scientific fundamentals included, the book covers important areas such as heating and cooling, passive solar applications, detoxification and biomass energy conversion. This comprehensive textbook provides examples of methods of solar engineering from around the world and includes examples, solutions and data applicable to international solar energy issues. A solutions manual is available to qualified instructors.

While the last few decades have witnessed incredible leaps forward in the technology of energy production, technological innovation can only be as transformative as its implementation and management allows. The burgeoning fields of renewable, efficient and sustainable energy have moved past experimentation toward realization, necessitating the transition to more sustainable energy management practices. Energy Management is a collective term for all the systematic practices to minimize and control both the quantity and cost of energy used in providing a service. This new book reports from the forefront of the energy struggle in the developing world, offering a guide to implementation of sustainable energy management in practice. The authors

provide new paradigms for measuring energy sustainability, pragmatic methods for applying renewable resources and efficiency improvements, and unique insights on managing risk in power production facilities. The book highlights the possible financial and practical impacts of these activities, as well as the methods of their calculation. The authors' guidelines for planning, analyzing, developing, and optimizing sustainable energy production projects provide vital information for the nations, corporations, and engineering firms that must apply exciting new energy technology in the real world. Shows engineering managers and project developers how to transition smoothly to sustainable practices that can save up to 25% in energy costs! Features case studies from around the world, explaining the whys and hows of successes and failures in China, India, Brazil, the US and Europe Covers a broad spectrum of energy development issues from planning through realization, emphasizing efficiency, scale-up of renewables and risk mitigation Includes software on a companion website to make calculating efficiency gains quick and simple
Number 3 of series of pocket reference books, published by the International Solar Energy Society; focuses on passive solar architecture. Book available with membership within the professional society ISES.

This handy pocket reference provides a wealth of practical information relating to solar energy and solar energy technologies. Topics covered include solar radiation and its detailed measurement, the emissivity and absorption properties of materials, solar thermal energy collection and storage, photovoltaics (both at all scales), solar cooling, and the use of solar energy for desalination and drying.

Provides consumers with home energy and money savings tips such as insulation, weatherization, heating, cooling, water heating, energy efficient windows, landscaping, lighting, and energy efficient appliances.

SOLVE ENERGY PROBLEMS QUICKLY AND ACCURATELY Filled with step-by-step procedures for performing hundreds of calculations, this practical guide helps you solve a variety of applied energy engineering design and operating problems.

Handbook of Energy Engineering Calculations features worked-out examples and enables you to obtain accurately results with minimum time and effort. Calculation procedures emphasize greenhouse gas and carbon dioxide emissions control as well as energy conservation and reuse. This is an invaluable, time-saving resource for anyone involved in energy engineering.

Comprehensive coverage includes: Energy conversion engineering Steam power generation Gas-turbine power generation Internal-combustion engine energy analysis Nuclear energy engineering Hydroelectric energy power plants Wind power energy design and application Solar power energy application and usage Geothermal energy engineering Ocean energy engineering Heat transfer and energy conservation Fluid transfer engineering Interior climate control energy economics Energy conservation and environmental pollution control

This handy guide helps readers quickly identify instrumentation. It includes data on control devices, monitors, and batteries, and a chapter on bar coding as a control procedure. **Pocket Guide to Instrumentation** is a handy guide that helps simplify procurement and handling of instrumentation equipment and accessories. It provides materials personnel with concise, straightforward information for identifying and tracking the many types of control devices, fittings, valves, etc. that accompany instrumentation

projects. It also includes data on cables, monitors, and batteries, and a chapter on how to use bar coding as a control procedure. Ideal for engineers, designers, and technical and clerical personnel involved in material procurement and control, this compact reference is packed with figures and tables that describe a wide range of standard instrumentation items. Ideal for engineers, designers, and technical and clerical personnel involved in material procurement and control, this compact reference is packed with figures and tables that describe a wide range of standard instrumentation items.

Solar Power Generation is a concise, up-to-date, and readable guide providing an introduction to the leading renewable power generation technology. It includes detailed descriptions of solar photovoltaic and solar thermal generation systems, and demystifies the relevant solar energy technology functions in practice while also exploring economic and environmental risk factors. Engineers, managers, policymakers, and those involved in planning and delivering energy resources will find this reference a valuable guide to help establish a reliable power supply to address social and economic objectives. Focuses on the evolution and developments in solar energy generation Evaluates the economic and environmental viability of the systems with concise diagrams and accessible explanations Demystifies the relevant solar energy technology functions in practice Explores economic and environmental risk factors

Climate change: watershed or endgame? In this compelling new book, Noam Chomsky, the world's leading public intellectual, and Robert Pollin, a renowned progressive economist, map out the catastrophic consequences of unchecked climate change—and present a realistic blueprint for change: the Green New Deal. Together, Chomsky and Pollin show how the forecasts for a hotter planet strain the imagination: vast stretches of the Earth will become uninhabitable, plagued by extreme weather, drought, rising seas, and crop failure. Arguing against the misplaced fear of economic disaster and unemployment arising from the transition to a green economy, they show how this bogus concern encourages climate denialism. Humanity must stop burning fossil fuels within the next thirty years and do so in a way that improves living standards and opportunities for working people. This is the goal of the Green New Deal and, as the authors make clear, it is entirely feasible. Climate change is an emergency that cannot be ignored. This book shows how it can be overcome both politically and economically.

Drawing on the authors' extensive research and project implementation around the globe, Solar Energy: Renewable Energy and the Environment covers solar energy resources, thermal and photovoltaic systems, and the economics involved in using solar energy. It provides background theory on solar energy as well as useful technical information for implementation

This book addresses the crucial question of how the essential needs of the growing human population can be met without breaking the Earth's already-stretched life-support system. With four out of five people predicted to be urban dwellers by 2080, 'One Planet' Cities proposes a pathway to genuine sustainability for cities and neighbourhoods, using an approach based on contraction and convergence. Utilising interviews with key players, including the Global Footprint

Network, World Future Council, WWF, mayors and government officials, and case studies from across the globe, including Europe, North and South America, Australia, South Africa, China and India, David Thorpe examines all aspects of modern society from food provision to neighbourhood design, via industry, the circular economy, energy and transport through the critical lens of the ecological footprint and relevant supporting international standards and indicators. Recommendations on managing supply chains and impacts, how the transition to a world within limits might be financed, and a deep examination of the Welsh Government's pioneering efforts follow. It concludes with an imagined vision of what a genuinely sustainable future might be like, and an appeal for 'one planeters' everywhere to step up to the challenge. This book will be of great interest to practitioners and policymakers involved in governance, administration, urban environments and sustainability, alongside students of the built environment, urban planning, environmental policy and energy.

This book contains the proceedings of the third in a now-biennial series organized by the Wessex Institute of Technology around the urgent need to determine solutions regarding sustainable development before our planet reaches a point of irreversibility. The aggressive search for new sources of energy and materials, the rapid rate at which natural resources are being consumed, and the destructiveness of the resulting pollution are all having a negative impact on the planet that needs to be stopped, if not reversed. As at the first two, participants at this conference will take stock of our situation and try to facilitate constructive principles and policies for a way forward, something that can only be done by transdisciplinary cooperation. Thus papers will examine ethical, political and social issues, health, safety and risk, lessons from nature, planning and development, and new technologies.

Retaining the successful format of the first edition and building on its solid grounding in the principles of renewable energy resources, this second edition has been revised in line with the latest advances in the field to include new technologies and an assessment of their impact. Considering each technology in depth from both scientific and environmental perspectives, it covers solar energy, photovoltaic, wind, wave, tidal and hydro power, biofuels, geothermals and more, as well as featuring a new chapter on institutional factors, including economics. In addition, extra worked problems and case studies are also provided to help readers put theory into practice. Reading and web-based material for further study is indicated after each chapter, making this text ideal, not only for practitioners, but also for students on multi-disciplinary masters degrees in science and engineering as well specialist modules in science and engineering first degrees.

Drawing on the experience of some of the foremost experts in the field, this easy-to-use and affordable pocket reference includes a wealth of information relating to solar energy and solar energy technologies. Topics covered range from solar

angles, sun path diagrams, solar radiation and radiative properties of materials through to thermal collectors, thermal energy storage, photovoltaics and daylighting. The book also includes conversion factors and constants and is peppered throughout with helpful illustrations, equations and explanations. Anyone with an interest in solar energy, including professional architects and engineers, home builders, academic researchers, students and energy consultants will find a host of answers in this book – a practical assimilation of data, fundamentals and guidelines for application.

Wind Energy: An Introduction covers wind energy system types, operation, modeling, analysis, integration, and control. Beginning with a history of the development of wind energy, this comprehensive book: Explains the aerodynamic theories that govern the operation of wind turbines Presents wind energy statistics to address the stochastic nature of wind The new edition of this thoroughly considered textbook provides a reliable, accessible and comprehensive guide for students of photovoltaic applications and renewable energy engineering. Written by a group of award-winning authors it is brimming with information and is carefully designed to meet the needs of its readers. Along with exercises and references at the end of each chapter, it features a set of detailed technical appendices that provide essential equations, data sources and standards. The new edition has been fully updated with the latest information on photovoltaic cells, modules, applications and policy. Starting from basics with 'The Characteristics of Sunlight' the reader is guided step-by-step through semiconductors and p-n junctions; the behaviour of solar cells; cell properties and design; and PV cell interconnection and module fabrication. The book covers stand-alone photovoltaic systems; specific purpose photovoltaic systems; remote area power supply systems; grid-connected photovoltaic systems and water pumping. Applied Photovoltaics is highly illustrated and very accessible, providing the reader with all the information needed to start working with photovoltaics.

A comprehensive account of how energy has shaped society throughout history, from pre-agricultural foraging societies through today's fossil fuel-driven civilization. "I wait for new Smil books the way some people wait for the next 'Star Wars' movie. In his latest book, *Energy and Civilization: A History*, he goes deep and broad to explain how innovations in humans' ability to turn energy into heat, light, and motion have been a driving force behind our cultural and economic progress over the past 10,000 years. —Bill Gates, *Gates Notes*, Best Books of the Year Energy is the only universal currency; it is necessary for getting anything done. The conversion of energy on Earth ranges from terra-forming forces of plate tectonics to cumulative erosive effects of raindrops. Life on Earth depends on the photosynthetic conversion of solar energy into plant biomass. Humans have come to rely on many more energy flows—ranging from fossil fuels to photovoltaic generation of electricity—for their civilized existence. In this monumental history, Vaclav Smil provides a comprehensive account of how energy has shaped society, from pre-agricultural foraging societies through today's fossil

fuel-driven civilization. Humans are the only species that can systematically harness energies outside their bodies, using the power of their intellect and an enormous variety of artifacts—from the simplest tools to internal combustion engines and nuclear reactors. The epochal transition to fossil fuels affected everything: agriculture, industry, transportation, weapons, communication, economics, urbanization, quality of life, politics, and the environment. Smil describes humanity's energy eras in panoramic and interdisciplinary fashion, offering readers a magisterial overview. This book is an extensively updated and expanded version of Smil's *Energy in World History* (1994). Smil has incorporated an enormous amount of new material, reflecting the dramatic developments in energy studies over the last two decades and his own research over that time.

Making your own off grid solar power system has never been easier!

Prepared and peer-reviewed by some of the foremost experts in the field, this easy-to-use pocket reference offers a wealth of information relating to wind energy and wind energy technologies. Topics covered range from wind resources to wind turbines, covering offshore and onshore power, both stand-alone and grid-connected. The book also includes vital information on international economic support schemes and incentives and environmental issues and is peppered throughout with helpful illustrations, equations and explanations. Renewable energy professionals, students and wind energy entrepreneurs amongst others will find a host of answers in this essential book – a practical assimilation of data, fundamentals and guidelines for application.

An expert introduction to the fascinating world of renewable energy and the transition from fossil fuels to clean energy that lies at the heart of a brighter climate future. In *Renewable Energy: Ten Short Lessons*, Stephen Peake distills the key issues of this timely subject, examining how we can harness the power of a range of groundbreaking energy technologies most effectively to achieve a sustainable energy future. Renewable energy is central to managing climate change and our transition to a sustainable energy supply for the 10 billion of us who will populate the earth by 2050. But how will we cope without fossil fuels to heat, cool, and light our buildings, power our industry, and run our transport systems? And are some renewables better than others? Packed full of easy-to-understand diagrams and fact boxes, these ten lessons cover all the basics, as well as the latest understanding and developments, to enlighten the nonscientist. About the series: The Pocket Einstein series is a collection of essential pocket-sized guides for anyone looking to understand a little more about some of the most important and fascinating areas of science in the twenty-first century. Broken down into ten simple lessons and written by leading experts in their field, the books reveal the ten most important takeaways from those areas of science you've always wanted to know more about.

A solid, quantitative, practical introduction to a wide range of renewable energy systems—in a completely updated,

The second edition of *Renewable and Efficient Electric Power Systems* provides a solid, quantitative, practical introduction to a wide range of renewable energy systems. For each topic, essential theoretical background is introduced, practical engineering considerations associated with designing systems and predicting their performance are provided, and methods for evaluating the economics of these systems are presented. While the book focuses on the fastest growing, most promising wind and solar technologies, new material on tidal and wave power, small-scale hydroelectric power, geothermal and biomass systems is introduced. Both supply-side and demand-side technologies are blended in the final chapter, which introduces the emerging smart grid. As the fraction of our power generated by renewable resources increases, the role of demand-side management in helping maintain grid balance is explored. Renewable energy systems have become mainstream technologies and are now, literally, big business. Throughout this edition, more depth has been provided on the financial analysis of large-scale conventional and renewable energy projects. While grid-connected systems dominate the market today, off-grid systems are beginning to have a significant impact on emerging economies where electricity is a scarce commodity. Considerable attention is paid to the economics of all of these systems. This edition has been completely rewritten, updated, and reorganized. New material has been presented both in the form of new topics as well as in greater depth in some areas. The section on the fundamentals of electric power has been enhanced, making this edition a much better bridge to the more advanced courses in power that are returning to many electrical engineering programs. This includes an introduction to phasor notation, more emphasis on reactive power as well as real power, more on power converter and inverter electronics, and more material on generator technologies. Realizing that many students, as well as professionals, in this increasingly important field may have modest electrical engineering backgrounds, early chapters develop the skills and knowledge necessary to understand these important topics without the need for supplementary materials. With numerous completely worked examples throughout, the book has been designed to encourage self-instruction. The book includes worked examples for virtually every topic that lends itself to quantitative analysis. Each chapter ends with a problem set that provides additional practice. This is an essential resource for a mixed audience of engineering and other technology-focused individuals.

This handy pocket reference provides a wealth of practical information relating to solar energy and solar energy technologies. Topics covered include solar radiation and its detailed measurement, the emissivity and absorption properties of materials, solar thermal energy collection and storage, photovoltaics (both at all scales), solar cooling, and the use of solar energy for desalination and drying. The book also includes conversion factors, standards and constants and is peppered throughout with helpful illustrations, equations and explanations, as well as a chapter making the business case for solar power. Anyone with an interest in solar energy, including energy professionals and consultants,

engineers, architects, academic researchers and students, will find a host of answers in this book – a practical assimilation of fundamentals, data, technologies and guidelines for application.

The Energy Problem Energy Resources: Availability, Management, and Environmental Impacts identifies historical increases in demand and a continuing lack of viable management policies for regional and global energy problems. Considering the state and consumption of energy resources on a worldwide level, the authors outline and address three primary issues that they view as growing concerns: the exploitation of current forms of energy, the environmental consequences, and the social and economic ramifications involved. The initial chapters offer an overview of energy management, providing an introduction to energy, energy-related engineering principles, regulations, energy conservation, and sustainability. The book discusses all energy resource forms from fossil fuels to renewable resources. The authors introduce an energy matrix providing an analytical structure that quantitatively can be used to evaluate resource options and their impacts. The concluding chapters provide insight into the driving forces that have shaped energy policy to date and the uncertainties that face future policymakers. The book analyzes various aspects of energy management. It poses concerns and offers solutions, including a proposed approach for developing, organizing, and implementing a national energy plan for the U.S. A Template for Developing an Energy Policy Examines the issues involved with energy management Explores the best options for achieving energy independence Provides quantitative approaches to energy policy development Discusses specific structural and analytical approaches to solving energy management problems The book considers conservation and the development of new, less expensive energy forms, and the impact these can make in slowing growth in demand while fueling efficiency. It analyzes the availability of traditional energy resources and a method of quantifying their energy, economic, and environmental impacts to provide adequate, inexpensive, long-term energy supplies. It also examines the feasibility of solar power, wind, tidal, geothermal, nuclear, and other less traditional sources of energy.

Solar energy is free, abundant and sustainable, with many methods existing to harness it. This guide is the essential introduction to the subject, explaining how the technologies work, how best they should be employed, and the costs and benefits of using them. It provides detailed yet accessible coverage of: passive solar building solar water heating solar space heating other solar thermal applications (such as cooling and desalination) grid-connected photovoltaics stand-alone photovoltaics. It also introduces the reader to larger scale applications such as concentrating solar power. Highly illustrated in full colour, this is the perfect primer for anyone who wants to work with or simply learn more about solar technologies.

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background detail, at-a-glance tables and diagrams, equations, and more, the Passive Solar Architecture Pocket Reference is a handy resource for architects, engineers and students. Coverage includes: definitions load determinants and Responses (including world wide biomes and climates, building metabolism and response, thermal sources and sinks, passive building responses to sources and sinks, tuning the building to the environment, optimizing insulation & thermal mass for comfort) contextual aspects (including microclimate and siting, temperatures, humidity, wind, radiation and comfort parameters passive components (including building envelope, passive solar terminology, orientation, apertures and glazing, thermal storage, thermal control and materials design tools (including sun path diagrams, sun peg diagrams, air flow relationships, thermal modelling and life cycle design specific functions (including passive heating, passive cooling and ventilation, natural lighting, passive water heating, resource collection and integrated design). The present book maximizes reader insights into the current and future roles to be played by different types of renewable energy sources and nuclear energy for the purpose of electricity generation in the European region as a whole and in a select group of European countries specifically. This book includes detailed analysis of the different types of renewable energy sources available in different European countries; the pros and cons of the use of the different types of renewables and nuclear energy for electricity generation; which energy options are available in the different European countries to expand their energy sector in the coming years; the impact on the climate and the environment; levels of production and consumption and the level of electricity generated by these energy sources, amongst others. Designed to inform government officials, economists, scientists and the private and public power industry of the key issues surrounding the future role of different renewable energy sources and nuclear energy in the production of electricity within the European region, this book will also describe in detail the evolution of the electrical energy sector in the chosen European region and the problems that several countries are now experiencing in the face of increasing demand for electricity.

The book explores basic concepts and advanced topics in the field of water technologies. It deals extensively with advances in materials, material selection, preparation, characterization and application. The relevance of water technologies in industries is considered, and a section is dedicated to describing and analyzing the technologies required for water reuse and advanced purification, including desalination. Nuclear desalination, low-carbon desalination and water purification technologies to address the adverse impacts of climate change are examined from both the adaptation and mitigation points of view. Aimed at senior undergraduate/graduate students in chemical, civil and environmental engineering, along with wastewater and desalination researchers, this book: Details advanced water treatments for varied processes. Describes membrane and desalination techniques for water reuse and advanced purification.

Elaborates water technologies at both the front and back ends of the process. Discusses modern technologies for effluent treatment and water recycling. Explores the role of information technology in the water sector.

In this work a predictive performance simulation of Solar Tower and Parabolic Trough Concentrating Solar Power plants was undertaken for three sites in Northern Nigeria. The simulation was done using Solar Advisor Model (SAM). The three sites - Minna, Kano, and Sokoto - were selected based on their Direct Normal Irradiation (DNI) values and hours of sunshine per day which are comparable to that of the sites where Concentrated Solar Power (CSP) plants are operating in Southern Spain. The simulation process adopted for this study includes: configuration of receiver and collector components, selection of Heat Transfer Fluid (HTF) and specification of the operating temperatures, sizing and configuration of solar field, specification of power cycle design point, specification of the thermal storage parameters, and optimization of hour of thermal energy storage, solar multiple and cooling system. The results show that the Solar Tower plant is more favoured to be adopted for use in the study sites because it has higher annual electrical energy generation, a higher capacity factor and lower Levelised costs of electricity. The Net Present Value of the CSP plants at all the sites is positive implying that the project is economically viable. The study also showed that at solar multiple of 2, the levelised cost of electricity for both Solar Towers and Parabolic Troughs is the lowest, irrespective of the cooling system (wet or dry cooling). Solar multiple has no effect on the water usage irrespective of the CSP plant. Dry cooling system reduces the water usage by 86% and 95% for Solar Tower and Parabolic Trough plants, respectively. The annual electrical energy generations of the CSP plants increase with increasing solar multiple. Dry cooling systems reduce the annual electrical energy generation in the range of 7.3 to 7.5 percent for the Solar Tower plant and 8 to 9 percent for the Parabolic Trough plant.

#1 NEW YORK TIMES BEST SELLER • In this urgent, authoritative book, Bill Gates sets out a wide-ranging, practical—and accessible—plan for how the world can get to zero greenhouse gas emissions in time to avoid a climate catastrophe. Bill Gates has spent a decade investigating the causes and effects of climate change. With the help of experts in the fields of physics, chemistry, biology, engineering, political science, and finance, he has focused on what must be done in order to stop the planet's slide to certain environmental disaster. In this book, he not only explains why we need to work toward net-zero emissions of greenhouse gases, but also details what we need to do to achieve this profoundly important goal. He gives us a clear-eyed description of the challenges we face. Drawing on his understanding of innovation and what it takes to get new ideas into the market, he describes the areas in which technology is already helping to reduce emissions, where and how the current technology can be made to function more effectively, where breakthrough technologies are needed, and who is working on these essential innovations. Finally, he lays out a

concrete, practical plan for achieving the goal of zero emissions—suggesting not only policies that governments should adopt, but what we as individuals can do to keep our government, our employers, and ourselves accountable in this crucial enterprise. As Bill Gates makes clear, achieving zero emissions will not be simple or easy to do, but if we follow the plan he sets out here, it is a goal firmly within our reach.

In 90 minutes, enough sunlight strikes the earth to provide the entire planet's energy needs for one year. While solar energy is abundant, it represents a tiny fraction of the world's current energy mix. But this is changing rapidly and is being driven by global action to improve energy access and supply security, and to mitigate climate change. Around the world, countries and companies are investing in solar generation capacity on an unprecedented scale, and, as a consequence, costs continue to fall and technologies improve. This publication gives an authoritative view of these technologies and market trends, in both advanced and developing economies, while providing examples of the best and most advanced practices. It also provides a unique guide for policy makers, industry representatives and concerned stakeholders on how best to use, combine and successfully promote the major categories of solar energy: solar heating and cooling, photovoltaic and solar thermal electricity, as well as solar fuels. Finally, in analysing the likely evolution of electricity and energy-consuming sectors - buildings, industry and transport - it explores the leading role solar energy could play in the long-term future of our energy system.

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