

# Introduction To Renewable Energy Project Finance Structures

Today, the tide has turned so strongly in favour of renewables that for the first time since the dawn of the fossil fuel era over two hundred years ago renewable energy technologies have started attracting more investment globally than that in the fossil fuel-based technologies. This text provides a comprehensive and wide ranging introduction to various renewable energy technologies and their applications, such as solar, wind, biomass, biogas, wave, geothermal, tidal and small hydel. It provides a thorough understanding of the basic energy conversion processes taking place in various renewable energy-based equipment like heat engines, photovoltaics, wind turbines, windmills, wave machines, and so on. The text also deals with the impact of renewable energy sources on global warming and pollution. The book is intended for courses in Environmental Sciences, Environmental/Electrical/Mechanical Engineering and Energy Studies at the undergraduate and postgraduate levels. It will also serve as a useful reference for scientists, technocrats and environmentalists.

As the demand for energy increases, and fossil fuels continue to decrease, Wind Energy: Renewable Energy and the Environment, Second Edition considers the viability of wind as an alternative renewable energy source. This book examines the wind

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industry from its start in the 1970s until now, and introduces all aspects of wind energy. The phenomenal growth of wind power for utilities is covered along with applications such as wind-diesel, village power, telecommunications, and street lighting.. It covers the characteristics of wind, such as shear, power potential, turbulence, wind resource, wind turbine types, and designs and performance. The text discusses the measurement and siting of individual wind turbines, and considers the development and economic impact of wind farms. What's New in the Second Edition: Expands the section on distributed wind Adds new sections on global warming, community wind, and storage Illustrates the need for a shift to renewable energy through discussions on energy use and the order of magnitude estimates for the lifetime of fossil fuels Discusses the interconnection of wind turbines to utility grids, regulations on installation and operation, and environmental concerns This book provides material on statistics, installation, types, and energy data, as well as new information, applications, and updates on the wind industry. It serves as a resource for practicing professionals in the wind energy industry, and can be used by undergraduate and graduate students in energy engineering/environmental engineering/wind technology.

This timely book examines the role played by regional authorities in the EU in the transition towards renewable energy. Drawing on both academia and practice, the expert contributors explore some of the key legal questions that have emerged along the e

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'The publication of *World in Transition: Towards Sustainable Energy Systems* is timely indeed. The World Summit on Sustainable Development gave great prominence to this challenge, but failed to agree on a quantitative, time-bound target for the introduction of renewable energy sources. The German Advisory Council on Global Change (WBGU) has now produced a report with a global focus, which is essential in view of the global impacts of climate change. The report provides a convincing long-term analysis, which is also essential. Global energy policies have to take a long-term perspective, over the next 50 to 100 years, while providing concrete guidance for decision-makers to implement now. There is an urgent need to secure energy supplies for the 2.4 billion people who still depend upon traditional biomass, while avoiding dangerous climatic changes. Our one world must close the gap between industrialized countries' surfeit and developing countries' poverty. Policies will need to consider both the broader environmental and specific climate constraints. I recommend this book very warmly to everyone concerned with global energy issues' Klaus Topfer, Executive Director, United Nations Environment Programme

*World in Transition: Towards Sustainable Energy Systems* underscores the urgent need to transform global energy systems so that the world's population has access to energy based on renewable sources. This is necessary to protect the global climate and to free those in developing countries trapped by energy poverty. Such an approach would also yield a peace dividend by reducing dependence upon regionally concentrated oil reserves. The authors stress

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that such a reconfiguration of energy systems is both feasible and fundable if rapid and resolute action is taken in the coming two decades. To this end, they propose a roadmap with specific milestones, making this an indispensable contribution to the scientific and policy debates on these critical issues and essential reading for those engaged with them.

SUSTAINABLE ENERGY focuses directly on energy related issues and includes a thorough treatment of all potentially viable energy sources. In most cases, individual chapters are devoted to each alternative energy approach. Although author Richard Dunlap covers past and current energy production methods, the text deals largely with future alternative energy strategies and follows the guidelines of ABET, the major engineering accreditation body. The book approaches these topics on a rigorous level -- familiarity with the basic concepts of freshman Physics and Chemistry is needed. The book contains enough material for a typical one semester course. The end-of-chapter problems are predominantly quantitative in nature. However, most are not straight forward calculations based on substituting values from the chapter in to the appropriate formula. The problems are designed to require the students to analyze information, to make use of material from previous chapters, to correlate data from various sources (not only from the textbook itself but from library, internet or other sources) and in many cases to estimate quantities based on interpretation of graphical data, interpolation of values and sometime just plain common sense. While maintaining a quantitative

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approach to the study of energy in our society, the text and accompanying problems show that this is a complex and very interdisciplinary topic. This approach is intended to provide students with an appreciation for the real problems that are encountered in the understanding of how we produce and use energy, and the realization that, while exact calculations are important and necessary, a broadly based analysis is often most appropriate. Important Notice: Media content referenced within the product description or the product text may not be available in the ebook version.

A great resource for beginner students and professionals alike Introduction to Energy, Renewable Energy and Electrical Engineering: Essentials for Engineering Science (STEM) Professionals and Students brings together the fundamentals of Carnot's laws of thermodynamics, Coulomb's law, electric circuit theory, and semiconductor technology. The book is the perfect introduction to energy-related fields for undergraduates and non-electrical engineering students and professionals with knowledge of Calculus III. Its unique combination of foundational concepts and advanced applications delivered with focused examples serves to leave the reader with a practical and comprehensive overview of the subject. The book includes: A combination of analytical and software solutions in order to relate aspects of electric circuits at an accessible level A thorough description of compensation of flux weakening (CFW) applied to inverter-fed, variable-speed drives not seen anywhere else in the literature Numerous application examples of solutions using PSPICE, Mathematica,

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and finite difference/finite element solutions such as detailed magnetic flux distributions  
Manufacturing of electric energy in power systems with integrated renewable energy sources where three-phase inverter supply energy to interconnected, smart power systems  
Connecting the energy-related technology and application discussions with urgent issues of energy conservation and renewable energy—such as photovoltaics and ground-water heat pump resulting in a zero-emissions dwelling—Introduction to Energy, Renewable Energy, and Electrical Engineering crafts a truly modern and relevant approach to its subject matter.

Over the past decade, the use of Renewable Energy Technology (RET) has significantly increased around the globe. Technologies that once were considered experimental are now being deployed on commercial scales at phenomenal rates, delivering cost-effective substitutions for conventional, fossil fuel-based systems that cause problems including greenhouse gas emissions, expensive operating costs, and global pollution. But these new systems come at a costly rate, and because of this, officials must review their overall efficiency and effectiveness. Global Sustainable Development and Renewable Energy Systems pushes through the boundaries of current research to introduce the concept of an energy management information system, exploring the role of energy for sustainable development. This book goes into great detail describing the benefits of these systems for organizations, focusing on corporate sustainability initiatives and activities to combat climate change. Research presented in this publication includes modeling techniques, software applications, and case studies that reveal how renewable energy sources such as wind, solar, and biomass fuel can have a

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significant implications for both operating costs and environmental impacts.

**Renewable Energy Finance: Theory and Practice** integrates the special characteristics of renewable energy with key elements of project finance. Through a mixture of fundamental analysis and real-life examples, readers learn how renewable energy project finance works in actual deals that mix finance, public policy, legal, engineering and environmental issues. The skills developed in analyzing non-recourse cash flow-based finance are applicable not only to green energy, but also apply more widely in project finance and infrastructure investing. The book's comparisons of developed and developing countries make it valuable to readers worldwide. Presents real world cases in each chapter Includes a companion website that contains renewable energy project finance models and other resources Supports efforts to achieve environmental sustainability through renewable financing projects and cleaner production techniques

This book contains selected papers presented during technical and plenary sessions at the World Renewable Energy Congress, the world's premier conference on renewable energy and sustainable development. All papers were rigorously peer reviewed. The Congress, held at Murdoch University in Perth, Western Australia from February 5 -9, 2017, with the theme of "Transition Towards 100% Renewable Energy", featured keynote speakers and parallel technical sessions highlighting technical, policy, and investment progress towards achieving 100% renewable energy ranging in scale from households to cities to large regions, with a focus on the challenges and opportunities transforming the global energy systems. The book highlights contributions from thought leaders involved in the supply, distribution, consumption, and development of sustainable energy sources.

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The World Renewable Energy Congress is a key event at the start of the 21st century. It is a vital forum for researchers with an interest in helping renewables to reach their full potential. The effects of global warming and pollution are becoming more apparent for all to see - and the development of renewable solutions to these problems is increasingly important globally. If you were unable to attend the conference, the proceedings will provide an invaluable comprehensive summary of the latest topics and papers.

As the world population grows and places more demand on limited fossil fuels, renewable energy becomes more relevant as part of the solution to the impending energy dilemma. Renewable energy is now included in national policies, with goals for it to be a significant percentage of generated energy within the coming decades. A comprehensive overview, *Introduction to Renewable Energy* explores how we can use the sun, wind, biomass, geothermal resources, and water to generate more sustainable energy. Taking a multidisciplinary approach, the book integrates economic, social, environmental, policy, and engineering issues related to renewable energy. It explains the fundamentals of energy, including the transfer of energy, as well as the limitations of natural resources. Starting with solar power, the text illustrates how energy from the sun is transferred and stored; used for heating, cooling, and lighting; collected and concentrated; and converted into electricity. A chapter describes residential power usage—including underground and off-grid homes—and houses that are designed to use energy more efficiently or to be completely self-sufficient. Other chapters cover wind power; bioenergy, including biofuel; and geothermal heat pumps; as well as hydro, tidal, and ocean energy. Describing storage as a billion-dollar idea, the book discusses the challenges of storing energy and gives an overview of technologies from

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flywheels to batteries. It also examines institutional issues such as environmental regulations, incentives, infrastructure, and social costs and benefits. Emphasizing the concept of life-cycle cost, the book analyzes the costs associated with different sources of energy. With recommendations for further reading, formulas, case studies, and extensive use of figures and diagrams, this textbook is suitable for undergraduates in Renewable Energy courses as well as for non-specialists seeking an introduction to renewable energy. Pedagogical Features: End-of-chapter problems Numerous case studies More than 150 figures and illustrations A solutions manual is available upon qualifying course adoption

This clear and concise book provides an overview of how laws and policies around the world are designed to support and accelerate the growth of renewable energy. Throughout, Professor Eisen focuses on how national and sub-national governments have responded to the revolutionary transformation of the world's energy system by developing and implementing support programs for renewable energy.

This book provides a quantitative yet accessible overview of renewable energy engineering practice including wind, hydro, solar thermal, photovoltaic, ocean and bioenergy. Suitable for engineering undergraduates as well as graduate students from other numerate degrees, the text is supported by worked examples, tutorial chapters providing background material and end-of-chapter problems.

This definitive guide to developing renewable energy CDM projects in Latin America - the largest market on the doorstep of the United States - provides business leaders, investors, project developers and host country offices with the one-stop guide to

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successful CDM renewable energy project development. The book opens with an accessible guide to the CDM that explains what it is and how it works in both theory and practice with a step-by-step guide for investors, project developers, consultants and Designated National Authorities (DNAs). The book then provides valuable country-by-country market analysis of Latin America with a focus on the electrical sector, renewable energy incentives and the overall investment climate that provides an authoritative guide to the most and least favourable places to develop projects. The final section provides guidance for how to overcome the identified barriers with practical actions for successful project development.

The recent rise to prominence of renewable energy and energy efficiency has been driven by their potential to lower the environmental impacts of energy use. As these technologies mature they must demonstrate not only their environmental benefits, but also their economic competitiveness. The relative costs and benefits of each potential project, whether large or small, must be systematically modelled and assessed before they can be financed and implemented. *Renewable Energy and Energy Efficiency: Assessment of Projects and Policies* deals with the appraisal of such projects against financial and non-financial criteria, illustrating the assessment tools necessary to make appropriate, evidence based decisions as efficiently as possible. The most important technologies are first described, stressing their economic and performance characteristics. Key project appraisal concepts are then introduced, approaches to

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modelling the cash flows in energy projects are described, and the issues of uncertainty and optimisation are fully discussed. These financial concepts, together with methods for estimating greenhouse gas emissions, are extended to address aspects of energy policy. Illustrated with many case studies this is an ideal introduction to financial and non-financial appraisal techniques as applied to energy efficient and renewable energy technologies.

Introducing Renewable Energy is about renewable energy that you can harness for a small scale 'micro power' project. It is designed to give the reader a view of what renewable energy is, how it works and what it can be used for. The book includes step-by-step instructions for two renewable energy projects, one solar PV and one wind project. However, it is not intended as a detailed 'how to' guide for installing all types of renewable energy system. Renewable energy is a big subject and if you have loftier ambitions than generating a small amount of energy for your own personal use, it is not possible to pack all the information that you are likely to need into a single book. Instead, read this as an introductory guide on the subject that will give you enough grounding for you to extend your knowledge with more specialized information later on. Although this book focuses on small scale renewable energy systems, it also covers larger scale systems at a high level. So if you are interested in finding out about energy production in general, about wind farms, or wish to gain some insight into the emerging title energy technology that promises to revolutionize the way we generate vast

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quantities of renewable energy in the future, this book will give you an understanding of what is possible with renewable energy, both now and in the near future. Whilst the author is a professional renewable energy engineer, the book has been written for the enthusiastic amateur, or for students who want an easy-to-follow introduction to the subject. It is also a perfect introduction for people who are interested in finding out whether they can install their own solar or wind farm, or other industrial scale renewable energy system, and wanting to get some basic understanding of the technology before they call in the professionals. Once you have read this book, you will have a clear understanding of the different options that exist for small renewable energy projects. If you have a project in mind, it will give you enough information for you to decide what type of renewable energy system is right for you and if all you want is a simple renewable energy system for generating some of your own personal off-grid energy, it will give you the knowledge to put together a simple system yourself.

economics of renewable Energy : Recent developments, 4th report of session 2007-08, Vol. 2: Evidence

This book covers electric energy from alternative energy sources including solar, wind, hydro, biomass, geothermal, and ocean energy. Core issues discussed include wind and solar resource estimates, characteristics of direct conversion, renewable energy analysis, electromechanical conversion, and storage devices used in alternative energy systems. Power system and smart grid issues associated with integration of renewable

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energy sources into the electric grid are explored in detail. Readers are encouraged to write their own solutions using the included MATLAB(R) scripts. In the near future the appearance and spatial organization of urban and rural landscapes will be strongly influenced by the generation of renewable energy. One of the critical tasks will be the re-integration of these sustainable energy landscapes into the existing environment—which people value and want to preserve—in a socially fair, environmentally sound, and economically feasible manner. Accordingly, *Sustainable Energy Landscapes: Designing, Planning, and Development* focuses on the municipal and regional scale, where energy-conscious interventions are effective, and stakeholders can participate actively in the transition process. This book presents state-of-the-art knowledge in the exciting new field of sustainable energy landscapes. It bridges the gap between theory and fundamental research on the one hand, and practice and education on the other. The chapters—written by experts in their fields—present a selection of interdisciplinary, cutting-edge projects from across the world, illustrating the inspiring challenge of developing sustainable energy landscapes. They include unique case studies from Germany, Taiwan, the United Kingdom, Canada, Denmark, Austria, Italy, and the United States. The editors and team of contributing authors aim to inspire readers, providing a comprehensive overview

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of sustainable energy landscapes, including principles, concepts, theories, and examples. The book describes various methods, such as energy potential mapping and heat mapping, multicriteria decision analysis, energy landscape visualization, and employing exergy and carbon models. It addresses how to quantify the impact of energy transition both on landscape quality and energy economy, issues of growing importance. The text infuses readers with enthusiasm to promote further research and action toward the important goal of building energy landscapes for a sustainable future.

Completely revised and updated, *Principles of Sustainable Energy Systems, Second Edition* presents broad-based coverage of sustainable energy sources and systems. The book is designed as a text for undergraduate seniors and first-year graduate students. It focuses on renewable energy technologies, but also treats current trends such as the expanding use of natural gas from fracking and development of nuclear power. It covers the economics of sustainable energy, both from a traditional monetary as well as from an energy return on energy invested (EROI) perspective. The book provides complete and up-to-date coverage of all renewable technologies, including solar and wind power, biological processes such as anaerobic digestion and geothermal energy. The new edition also examines social issues such as food, water, population, global

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warming, and public policies of engineering concern. It discusses energy transition—the process by which renewable energy forms can effectively be introduced into existing energy systems to replace fossil fuels. See What's New in the Second Edition: Extended treatment of the energy and social issues related to sustainable energy Analytic models of all energy systems in the current and future economy Thoroughly updated chapters on biomass, wind, transportation, and all types of solar power Treatment of energy return on energy invested (EROI) as a tool for understanding the sustainability of different types of resource conversion and efficiency projects Introduction of the System Advisor Model (SAM) software program, available from National Renewable Energy Lab (NREL), with examples and homework problems Coverage of current issues in transition engineering providing analytic tools that can reduce the risk of unsustainable fossil resource use Updates to all chapters on renewable energy technology engineering, in particular the chapters dealing with transportation, passive design, energy storage, ocean energy, and bioconversion Written by Frank Kreith and Susan Krumdieck, this updated version of a successful textbook takes a balanced approach that looks not only at sustainable energy sources, but also provides examples of energy storage, industrial process heat, and modern transportation. The authors take an analytical systems approach to energy

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engineering, rather than the more general and descriptive approach usually found in textbooks on this topic.

Multiple Choice Questions on Renewable Energy book contains over 1500 multiple choice questions covering various sectors of renewable energy, including solar, wind, biomass, biogas, biofuels, hydro, energy from wastes, hydrogen, geothermal, ocean, tidal, and waves. The book has three levels of questions, ranging from school to graduate levels. A comprehensive overview of renewable energy development in India has also been presented. This book is useful for academicians, students pursuing engineering or agriculture-related courses, aspirants of various competitive exams, professionals, and stakeholders in the renewable energy sector. It can also be used for quiz programmes organized in schools, universities, engineering institutions, and on television. This publication explores the progress in energy efficiency and renewable energy in selected countries of South-Eastern Europe, Eastern Europe, and Central Asia, and in the Russian Federation. The study analyzes policy, legislative and regulatory frameworks, financial environment and level of awareness in the areas of energy efficiency and renewable energy from 2010 to the present. It also identifies the existing gaps at the required frameworks and environment to promote energy efficiency and renewable energy investments in the countries.

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This study is intended to support countries in their ongoing efforts towards improving energy efficiency and building a strong renewable energy base. It proposes a set of recommendations for necessary steps in achieving the long-term objectives for energy mix and meeting the ambitious related targets set by the countries.

Introduction to Renewable Energy Conversions examines all the major renewable energy conversion technologies with the goal of enabling readers to formulate realistic resource assessments. The text provides step-by-step procedures for assessing renewable energy options and then moves to the design of appropriate renewable energy strategies. The goal is for future engineers to learn the process of making resource estimates through the introduction of more than 140 solved problems and over 165 engineering related equations. More than 120 figures and numerous tables explain each renewable energy conversion type. A solutions manual, PowerPoint slides, and lab exercises are available for instructors. Key Features Covers all major types of renewable energy with comparisons for use in energy systems Builds skills for evaluating energy usage versus environmental hazards and climate change factors Presents and explains the key engineering equations used to design renewable energy systems Uses a practical approach to design and analyze

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renewable energy conversions Offers a solutions manual, PowerPoint slides, and lab activity plans for instructors

Wave, tidal and offshore wind technologies have long held the promise of seemingly limitless energy supplies. In practice, while offshore wind is growing relatively rapidly, all three sectors have lagged behind expectations. This book, from the International Energy Authority Renewable Energy Technology Deployment implementing agreement (IEA-RETD), examines the reasons for this and suggests how barriers to deployment might be overcome. Beginning with an assessment of the marine energy resource, it provides a detailed introduction to the main technologies currently being employed to harness wind, tidal and offshore wind power. It then examines the types of policies which are used to encourage deployment around the world, and progress towards meeting targets. The economics of offshore energy projects are discussed, along with risks that projects face and the types of finance which are available. A final section turns to barriers - both technical and non-technical (including environmental, health and safety, skill related, supply chain and more) - and in all cases suggests how to mitigate and remove these barriers. Highly illustrated in full colour, this is an indispensable resource for anyone - whether in industry, policy or academia - looking to learn more about how deployment of offshore renewable energy

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technologies can be encouraged.

Please note that the content of this book primarily consists of articles available from Wikipedia or other free sources online. Pages: 31. Chapters: Renewable energy in Asia, Dynamic tidal power, Solar-powered pump, Humber Gateway Wind Farm, Westernmost Rough, Walney Wind Farm, Teesside Wind Farm, Clean Energy Bank, Race Bank, West Duddon wind farm, Docking Shoal, Solar America Cities, European Renewable Energy Council, Solar chemical, Wind power in Wyoming, Sunlight Electric, Dudgeon Offshore Wind Farm, Solar charger, SymbioCity, Isaac Berzin, Enercon E-126, Wolfgang Scheffler, Wind power in Pakistan, Great Eppleton Wind Farm, Binary cycle, Langley Park Wind Farm, Trimdon Grange Wind Farm, Holmside Hall Wind Farm, Blyth Harbour Wind Farm, John Twidell, ASTM D6751, Total spectrum solar concentrator, Levi Yissar, Wind power in Morocco, West Durham Wind Farm, Wind power in Iran, Photofermentation, Zero-carbon city, Triton Knoll, Liberty Wind Turbine, Biomass Research and Development Board, Treethanol, Solar roadway, Enova SF, Delabole wind farm, Manjil and Rudbar Wind Farm, Blyth Offshore Wind Farm, Solar lamp, Wavegen, Biofuel policy of Malaysia, Greentech Media, Lovecraft Biofuels, Geothermal power in Japan, Rinky Dink, COMES, Aventine Renewable Energy, Lake piston, Oceana Energy, Wind power in Estonia, Marine current power, Wind Farm Bukowsko-Nowotaniec, State Energy Program, Solar Power International, Appliance Efficiency Program, OE buoy, Wind power in Hungary, Green Growth, Water power

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engine, Gund Institute for Ecological Economics, Shiraz Biogas Power Plant, Chicken fat, Water scoop, Premier Power Renewable Energy, Inc, Alternative Energy Promotion Centre, Ice pond, Corn kernels, Enron Wind, Tidal farm, Verdant Power, World Council for Renewable Energy, Hybrid power source, Bioenergy Action Plan, Genesis Energy, H-Bio, Trestle, Johannesburg Renewable Energy Coalition, Solar Tuki, Task 40, Sky footage, Second Wind, Zero emission project, Opatov...

What is project finance? What makes project or structured finance so relevant for large renewable energy infrastructure? Which vocabulary do I need to know in order to speak the same language during meetings with lawyers, investors, bankers and engineers? These questions and many more are answered throughout this book, offering real world examples to bridge the gap between theory and practice. The book details the role of each stakeholder in the development of renewable energy projects, the interconnection between all the agreements, the financial process from fundraising to financial close, the processes of due diligence, risk analysis, project investment valuation and much more. It also provides with an introduction to Portfolio Management using renewable energy assets and an explanation of the role of Climate Finance in green energy investments. The commented glossary enables readers to unpick the jargon used in project finance for renewable energy, and the numerous creative figures and comprehensive tables aid with understanding. Offering a complete picture of the discipline, Introduction to Project Finance in Renewable Energy Infrastructure will be of

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value to professionals, engineers and academics alike interested in understanding the process and components of project finance in renewable energy infrastructures, in both private and public-private contexts.

The second edition of this standard text reflects the experience gained as a result of the rapid developments in renewable energy technologies, and will be of use to both students and professionals.

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