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OVERVIEW

Renewable energies are part of a sector that developed greatly towards the end of the 1990s, but most of all in the last few years in a practical sense, all over Europe, and right now in most of the emerging countries. In renewable energy, solar, wind, and geo-thermal energy, among others, have been in a process of increasing industrialization and marketing in recent years. Logically, until there is a sufficiently consolidated market volume in those emerging countries, these types of energies will not be able to compete in the same conditions with the so-called conventional ones. However, social awareness of these new energy forms, as well as their diffusion and establishment in the energy market is still in full growth. This will contribute towards the consolidation of the market for renewable energy in the coming years.

Over the last decade, a great number of books, projects, and doctoral theses have been developed regarding aspects on the application of green energy. In particular, some researches set out installations, mathematical approaches, and methodologies that represent an important support in the search for solutions to technical problems in the field of sustainable energy. These topics form the base from which this book has been intended to be developed. With that purpose, this publication aims to be an essential reference source, building on the available literature in the field of renewable energies in developing countries while providing for further research opportunities in this dynamic field. With contributions from leading researchers, each chapter presents a fresh look at today’s current topics. Therefore, it is hoped that this text will provide the resources necessary for managers, technology developers, scientists, and engineers to adopt and implement sustainable practices in developing nations across the globe.

SUMMARY OF TOPICS

Highly experienced contributors have collaborated in the completion of this book. Their chapters have deeply analyzed topics related to the development of green techniques, promotion, implementation, and adoption mainly in developing countries. Therefore, the book covers areas including, but not exclusively, related to engineering and management. Some of these relevant topics are indicated here below:

- Energy and Sustainability;
- Thermal and Photovoltaic Solar Systems;
- Wind Turbines and Wind Farms;
- Industrial Assets Management;
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- Globalization of Environmental Issues;
- Production and Consumption of Renewable Energy;
- Dependability;
- Power Consumption and Management;
- Social Implications of Green Energies;
- Renewable Energies in Developing Countries;
- Industrial Management and Reliability Analysis on Renewable Energies.

The book has been also intended to provide a practical view, trying to promote green techniques from educational point of view and mainly thinking in the development of emerging countries. Each chapter in the book focuses on specialized topics for greater understanding of the chosen subject and provides detailed discussions of emerging issues, offers cutting-edge views on new horizons, and deepens the understanding in these mentioned topics. This book aims to provide a holistic viewpoint of the topics covered from both an academic and applied angle.

TARGET AUDIENCE

Engineers, academicians, researchers, advanced-level students (both postgraduate and doctoral), technology developers, and managers who take decisions on this field will find this text useful in furthering their research exposure to pertinent topics in sustainable energy and assisting in furthering their own research efforts in this field. Promoting Sustainable Practices through Energy Engineering and Asset Management is aimed at the mentioned target audience worldwide and provides an in depth look at current global concerns. The book brings together a set of highly concentrated researches that will provide in depth knowledge to engineers, academicians, etc. This wide audience is appealed by this book providing with deeper knowledge on a broad set of emerging issues in the global promotion of sustainable practices.

ORGANIZATION OF THE BOOK

The book is organized into two sections. The first section refers to “Wind, Solar, and Other Renewable Energies” and is developed in seven chapters. The second section is related to bordering topics about asset management and green energies and is developed in eight chapters. A brief description of the fifteen chapters, related to their research matter and the conclusions they achieved, are gathered and summarized as follows:

Chapter 1 deals with wind farms installations and presents a decision support system based on a bipolar multicriteria analysis. Among renewable energy, wind power is an energy that does not require fuel and which does not generate greenhouse gas and toxic wastes. Thus, wind power is easily a form of “clean green energy.” Since wind farm selection problem requires the involvement of multiple variables, positive and negative criteria are considered distinctly to represent potential wind farms by selectability (positive criteria) and rejectability (negative criteria) measures. Due to the complexity of the socio-economic environment and the rapid technological evolution, a post-evaluation study on wind farm planning is essential to optimize management ability and minimize losses. Considering the satisficing game theory, a final choice of each actor is represented with a satisficing equilibrium set. A post-evaluation
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study on wind farm planning consists in a set of selection indicators proposed in literature in order to evaluate wind farm planning. Basically, the advantages of the model proposed by chapter 1 is that it can be adjusted for other forms of sustainable energy selection process such as hydroelectricity, solar energy, geothermal energy, etc.

Chapter 2 provides new and original solutions which are currently being tested to wind turbines by the employment of a multilevel turbine concept. The researcher is inclined to consider bending moments at the bottom of a large wind tower as a very probable reason for accelerated wind turbine wear. Moment direction oscillations would cause cracking of concrete foundations, with cascading effects, as a loosened tower can gain momentum before hitting the concrete instead of just pushing on it. As the research is ongoing and brings new input every month, this lecture should be treated as an introduction to the topic, and, as the author explains, any persons interested in the results or applications of this research are encouraged to contact him for newer and more specific results. Nevertheless, currently it is only certain, that limiting destructive forces at critical points of a wind turbine can be used to limit material costs or increase reliability. Therefore, the presented solution not only helps achieve specific goals for a wind turbine, but also simplifies the manufacturing and transportation of large-scale its components.

Chapter 3 presents new and easy implementable scheme for assessment of the profitability of changing a turbine for a hydroelectric power plant. The researchers indicate that small and privately owned hydroelectric power plants, which have been in use for more than a decade are usually equipped with specific types of turbines, which for most installation conditions give a much lower annual energy production than a Kaplan turbine installed for the same water conditions would. Due to these reasons, the presented method can be successfully used as a case study element of a business plan or in the long term fiscal forecast of currently running installation. It is the authors’ belief that site specific data from everyday reading for the time period of no less than one decade, if available, can be used, by the method described, to create more reliable modernization profitability analyses for small hydroelectric power plants.

Chapter 4 analyzes the requirements that thermal solar system must fulfil in reference to components, work flow, safety systems etc. according to European Standard EN 12976. The installation of these systems is not considered in the above mentioned regulation, but it does include all requirements in the documentation for the person performing the installation and for the final user. In addition to that, this norm expresses also the distinct testing methods applied to domestic solar energy systems for the validation of the prior requirements. With that goal, throughout that chapter the basic concepts related to solar energy utilization and regarding to product quality are defined. Test procedures are also depicted for the validation of prefabricated systems, resulting finally a categorization of the thermal performance. At the end, this chapter presents a test method developed to provide a reliable answer, but at the same time, fast as possible and at a minimum cost.

In Chapter 5, a reliability test installation for water heating systems is presented, following the requirements and design indicated in the European Standard EN-12976. In this chapter, different testing methods applied to domestic solar energy systems are analyzed for the validation of the standard requirements. With this purpose, authors consider for the test installation design, firstly, the requirements that the hydraulic circuit of such an installation must meet, followed by the specifications required by the custom-built systems; all of this has the aim of certifying that the characteristics of the prefabricated system are the applicable ones. Subsequently, the chapter proceeds to design a test installation, which is also compared to a real installation. As far as the interest in thermo-solar energy is growing worldwide and it is usual the setting of new norms in order to commercialize related products in different markets, this chapter may be a good example and aid for those emerging countries who are nowadays applying new standards in this field along with the growth of the global solar market.
Chapter 6 shows how the interest in solar photovoltaic energy is growing worldwide. In particular, this chapter deals with electricity production from small scale photovoltaics in urban areas, highlighting that the major advantage of solar photovoltaic energy systems is that they generate electricity pollution-free and can be easily installed on residential and commercial buildings as grid-connected applications. As the authors indicate, photovoltaics present high interest in community due to fact that the sun is freely providing light in huge quantities and it is expected to be shining for the next hundred million years. Therefore, there is more than enough solar irradiation available to satisfy the world’s energy demands. It represents a situation of energy for all. The benefits of the implementation of small-scale photovoltaic generators are, for example, the support to the low voltage distribution network, the contribution in the green of cities and urban areas and, of course the relevant effort of reducing the greenhouse gases emissions. All these data presented and discussed, support the opinion that the photovoltaic systems can help to achieve sustainability and the role of small- scale low cost installation can be an additional advantage, since they can be easily implemented in urban areas.

Chapter 7 describes the features of the integration of renewable energy sources into the Ukrainian power grid, trying to answer questions about the potential of Ukraine, the barriers of its implementation, and the legislation for the regulation of this process. According to the authors, the problem of limited energy resources and their wasteful usage becomes more important from year to year. The primary energy resources are essentially used for production of two types of energy: heat and electricity. The urgent problems in the field of energy management using the information modeling of the electrical power grids and district heating were studied. This chapter comments that, according to the analysis of existing methods that can be applied in information modeling problems, there are many ways of solving such issues. Thus, further research in the field of power grids construction with the renewable energy is aimed to simulate smart grids with different parameters of the renewable energy to achieve their optimal combinations.

In Chapter 8, authors apply existing theoretical models to determine their suitability for predicting the chatter profile of parts in a plunge grinding process. Maintenance has of course a significant impact on the environmental sustainability of an organization. Particularly, predictive maintenance is based on measuring and recording certain physical parameters associated with a working machine in order to obtain data and information through which failures can be detected, so the future state of the machine may be determined. The presented methodology therefore can be applied to predict the remaining life of a machine or equipment, providing a quality control in high precision processes. In other words, the researchers describe a methodology that can contribute to increasing the environmental sustainability of manufacturing organizations with a more efficient use of resources, as the quality of pieces can be guaranteed; therefore, the energy used in manufacture, the material used to make the work pieces and the effort involved in the process of remanufacture is avoided.

Chapter 9 refers to renewable energy sources from the point of view of a system safety analysis. The chapter suggests how the selection of operating parameters that guarantee process quality (acceptable chattering levels) is not possible using a theoretical analysis. Basically, the methodology described by the author may contribute to increasing the environmental sustainability of manufacturing organizations with a more efficient use of resources, as the quality of pieces can be guaranteed. Therefore, the energy used in manufacture, the material used to make work pieces and the effort involved in the process of remanufacture is avoided. Renewable energies are presented as a controversial topic depending on
several matters (like the political persuasion, proposed financial gains or lose etc.) which makes objective research difficult. The research considers that, given the likelihood of occurrence and the potential consequences of using sustainable energy sources (wind and solar), renewable energies should continue to evolve and displace as much of the traditional energy sources as feasible. In fact, it states there are no safety hazard that cannot be controlled to prohibit the growth of renewable energy sources as they are our future and the safer option.

Chapter 10 states how the major challenges that the host developing countries confront is to manage the process of globalization in such a way that it promotes environmental sustainability and equitable human development. According to the chapter, on the one hand, globalization accelerates structural change, thereby altering the industrial structure of countries, for instance the excessive use of natural resources and contributes to the pollution levels. However, on the other hand, globalization transmits and magnifies market failures and policy distortions that may spread and exacerbate environmental damage; it may also generate pressures for reform as policies heretofore thought of as purely domestic attracts international interest. Therefore and in reference to the globalization process, the author considers that in the presence of diversity of environmental endowments, assimilative capacities and preferences efficient environmental management requires sensitivity to local ecological and social conditions which cannot be ignored towards having viable environmental sustainability.

In Chapter 11 and addressing climate change, the development and deployment of advanced and innovative clean technology are an innovation imperative. According to the authors, the International Energy Agency (IEA) report from 2008 states that clean technology innovation must rise by a factor between two and ten to meet global climate change goals. Therefore, the roles of clean technology transfer and the related intellectual property rights are receiving much attention from industry and policy makers. The chapter states that clean technology companies specified the following top three intellectual property services required from service providers: intellectual property protection, intellectual property contracting, and Intellectual property portfolio analyses. Consequently, outsourcing industrial property matters to trusted external experts are evident in current clean technology industry and it is an accepted management practice among clean technology companies that saves money and time for companies.

Chapter 12 expresses that the reliability model is an essential aspect for the management and optimization of physical industrial assets. Particularly, model and analysis of repairable equipment are of great importance, mainly in order to increase the performance oriented to reliability and maintenance as part of the cost reduction. The wide range and variability of their behavior, demands the application of techniques of diverse complexity and depth, which allow adapting in a better way to each one of the realities. That research becomes an analytic and explicative procedure about the definition, calculation methodology and criteria that must be considered to parameterize industrial assets under certain degradation level after maintenance, complementing in addition its analysis with a numeric application that allows demonstrating step by step the mathematic and stochastic development as appropriate. The practical cases chosen were developed in the mining industry of Chile.

Chapter 13 shows how some companies nowadays are making efforts in reducing their environmental footprint, driving for sustainability and responsible use of natural resources where they operate in. Authors indicate how industry is facing a lot of pressure to stop pollution, to use electrical energy and water in a sustainable way, use ethically sourced material and usage of environmental friendly, non-hazardous (green) materials. The chapter particularizes the topic in a specific corporation, whose vision
and mission is internalized by its various business units and departments. Alignment is done at all levels through virtual open forums, departmental meetings, Q&As, and through staff meetings. Employees are encouraged to submit ideas for sustainability and are provided funds to put those ideas into action. Nevertheless, authors consider that much work still needs to be done and the monitoring and publishing of environmental and social KPIs will help in persuading reluctant organization to adopt industry best practices.

Chapter 14 is focused on the current situation about the supply chain agenda in Malaysian manufacturing firms. As climate change becomes one of the top agendas of the world, firms are voluntarily submitting their carbon emissions and adopting renewable energy because of uncertainty in petroleum price and unattractive economic factors. According to the authors, Malaysia is expected to increase gross domestic products which concentrate on international trade. As a consequence, supply chain members should focus on reducing carbon emission and cost of carbon production through the redesign of their current process to latest low carbon process. In addition to this, they consider that manufacturing firms must voluntary participate in government effort to promote low carbon practices because it will benefit firms when policymakers start enacting environmental policy that is suitable for industrial firms.

Finally, Chapter 15 highlights the role of supply chain integrity in Green Supply Chain Management (GSCM) leading to business performance. According to the authors, corporate organizations have begun to have raised interest on the environmental impacts caused by the operation and have started to modify their business processes to be more eco-friendly. The chapter offers a conceptualization based on content analysis of academic journals where most of the articles highlight that integration among supply chain members are the most important factor in GSCM, while competing companies could mutually progress in GSCM should they agree to collaborate. Authors indicate that the adoption of supply chain integration is considerably quite slow especially in developing countries which value competition more than competition even along the vertical chain. This should be therefore improved as GSCM could only function and assist in achieving sustainable business performance, should the firm is confidence on the reliability and integrity of its partners.

CONCLUSION

Throughout this preface, we have observed an overview of the entire book, trying to describe how these topics regarding energy engineering and asset management fits in the world today. In addition to this, it is also indicated the target audience to whom this book is mainly focused, and a brief summary of the importance of each of the chapter included, providing a description of each one. As already commented, the target audience is constituted by professionals, researchers, and students working in the fields of energy engineering and asset management. In order to comment how this book impacts the field and contributes to the subject matter, it is important to underline that this work looks to discuss and address the difficulties and challenges that developing countries face in implementing this kind of green energy, while describing, in a brief manner, methodologies and tools to be applied in accordance with the environmental sustainability.
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The book is, in few words, a repository of ways to improve the quality of energy processes by identifying sustainable practices, while applying asset management techniques and methods as well as an improvement of business processes. To a greater or lesser extent, each chapter provides a set of quality management methods, statistical tools, or just a diverse point of view to promote different sustainable practices in order to improve asset life cycle, customer satisfaction, reduction in pollution, cost reduction, profit increase, etc. Engineering and educational practices already implemented in developed countries can provide examples (to follow, adapt, or to avoid) in order to promote these renewable energies in the new emerging countries. The 15 chapters address different aspects for promotion of sustainable practices as well as the various engineering, mathematical approaches, and/or management tools that may provide a better understanding and awareness of the so-called green energies. Additionally, the book is intended to explore the impact of such practices on emerging countries in which the governments are implementing them.

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