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Renewable Energy Desalination

An Emerging Solution to Close the Water Gap in the Middle East and North Africa

World Bank Publications The Middle East and North Africa (MENA) Region is one of the most water stressed regions in the world. Due to increasing population and projected climate change impacts, MENA's annual water demand gap is projected to grow five-fold by 2050, from today's 42 Km³ to 200 km³ by 2050. Despite its extreme scarcity, water is managed poorly. Inefficiencies are common in the agriculture, municipal and industrial systems; and many utilities are financially unsustainable. As a result, countries over exploit their fossil aquifers - and use desalination by fossil fuel-to meet the water demand gap. Desalination is costly, energy intensive and has environmental impacts. Over exploitation of fossil aquifers is not sustainable. Neither is the use of fossil fuel for desalination to meet the growing water gap. This book outlines the challenges in terms of water (and also in terms of energy) that countries in the region face and analyses the scope of available options to address the growing water gap. It estimates MENA's water gap today and into the future - until 2050, and presents a methodology to prioritise options to bridge the water gap, using the 'marginal cost of water' approach. The book also assesses the viability of renewable energy desalination as an important option to close the Region's water gap.

Renewable Energy Desalination

An Emerging Solution to Close the Water Gap in the Middle East and North Africa

The Middle East and North Africa (MENA) Region is one of the most water stressed regions in the world. Water scarcity has already become a challenge to development in many of the countries. Due to increasing population and Projected climate change impacts, MENA's annual water demand gap is projected to grow five-fold by 2050. Despite its extreme scarcity, water is managed poorly. Inefficiencies are common in the agriculture, municipal and industrial systems; and many utilities are financially unsustainable. As a result, countries overexploit their fossil aquifers-- and use desalination by fossil fuel-- to meet the water demand gap. Desalination already plays a critical role in MENA's water supply portfolio. However, desalination is costly, energy intensive and has environmental impacts. On current trends, the projection is that, by 2050, Saudi Arabia and many other countries in the Region will consume for desalination most of the oil that they produce. Overexploitation of fossil aquifers is not sustainable. Neither is the use of fossil fuel for desalination to meet the growing water gap sustainable. This book outlines the challenges in terms of water (and also in terms of energy) that countries in the Region face and analyzes the scope of available options to address the growing water gap. The book estimates MENA's water gap today and into the future-- until 2050; and presents a methodology to prioritize options to bridge the water gap, using the 'marginal cost of water' approach. The book also assesses the viability of renewable energy desalination as an important option to close the Region's water gap. The book compares the economic cost of desalination using fossil fuel and renewable energy sources, in particular the Concentrated Solar Power (CSP). The book also provides recommendations as to how CSP based desalination could ensure sustainable water supply for the Region.

Renewable Energy Desalination

An Emerging Solution to Close the Water Gap in the Middle East and North Africa

World Bank Publications The book looks at water availability and water demand in various sectors till 2050, presenting a methodology to prioritize options both on the demand and on the supply side, with a special focus on renewable energy desalination.

Solar Desalination Technology

Springer 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.

Microgrids

The Path to Sustainability

MDPI Microgrids are a growing segment of the energy industry, representing a paradigm shift from centralized structures toward more localized, autonomous, dynamic, and bi-directional energy networks, especially in cities and communities. The ability to isolate from the larger grid makes microgrids resilient, while their capability of forming scalable energy clusters permits the delivery of services that make the grid more sustainable and competitive. Through an optimal design and management process, microgrids could also provide efficient, low-cost, clean energy and help to improve the operation and stability of regional energy systems. This book covers these promising and dynamic areas of research and development and gathers contributions on different aspects of microgrids in an aim to impart higher degrees of sustainability and resilience to energy systems.

Recent Progress in Desalination, Environmental and Marine Outfall Systems

Springer This book collects current scientific information on advanced technologies and management practices associated with the desalination industry in the Middle East and elsewhere around the world. The book opens with introductory chapter which briefly recounts the history of desalination, and describes the current state of development in the field. Part I: Desalination Systems includes ten chapters which describe a variety of techniques and designs intended not only to minimize the impact of desalination, but also to save energy and use natural resources to maximize the output of integrated desalination systems. Among the highlights are a chapter on the use of ceramic membrane technology for sustainable oil water production; a case study on the use of solar heating systems in desalination technology in Oman; discussion of fouling and its effect on design and performance of desalination systems; a review of shore approaches and sea-lines with case studies from Australia and Germany; and a discussion of the integration of desalination technology with renewable energy for climate change abatement in the Middle East and North Africa region. Part II: Environmental Systems includes among others a chapter on regulating the use of water resources and desalination technology on a regional scale reducing the carbon footprint of desalination, with examples from Australia; a description of desalination for irrigation in the Souss Massa region in the south of Morocco; a study of the impact of the coastal intake environment on operating conditions of thermal desalination plants in the United Arab Emirates; a discussion of hydrodynamic and thermal dispersion modeling of the effluent in a coastal channel, with a case study from Oman; and a mathematical model study of effluent disposal from a desalination plant in the marine environment at Tuticorin in India. The book aims to inspire developments in desalination technologies which are specifically aimed at reducing energy consumption and cost, and minimizing environmental impact.

Desalination and Water Treatment

BoD - Books on Demand The need for fresh water is increasing with the rapid growth of the world's population. In countries and regions with available water resources, it is necessary to ensure the health and safety of the water supply. However, in countries and regions with limited freshwater resources, priority is given to water supply plans and projects, among which the desalination strategy stands out. In the desalination process, membrane and thermal processes are used to obtain fresh water from salty water that is in abundant amounts in the sea. This book will outline valuable scientific contributions to the new desalination and water treatment technologies to obtain high quality water with low negative environmental impacts and cost. The editors would like to record their sincere thanks to the authors for their contributions.

Renewable Energy Technologies for Water Desalination

CRC Press The book presents a thorough overview of the latest trends and challenges in renewable energy technologies applications for water desalination, with an emphasis on environmental concerns and sustainable development. Emphasis is on the various uses of renewable energy, as well as economics & scale-up, government subsidies & regulations, and environmental concerns. It provides an indication on how renewable energy technologies are rapidly emerging with the promise of economic and environmental viability for desalination. Further it gives a clear indication on how exactly to accelerate the expansion and commercialization of novel water production systems powered by renewable energies and in what manner environmental concerns may be minimized. This book is all-inclusive and wide-ranging and directed at decision makers in government, industry and the academic world as well as students.

Towards a new generation of policies and investments in agricultural water in the Arab region

fertile ground for innovation. Background paper prepared for the high level meeting on agricultural water policies and investments

International Water Management Institute (IWMI)

Solar Energy Pocket Reference

Second edition

Taylor & Francis 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.

Marine Environmental Impact of Seawater Desalination Science, Management, and Policy

Elsevier **Marine Environmental Impact of Seawater Desalination: Science, Management and Policy** combines existing studies with the personal research of the author into a unified work describing the effects of seawater desalination on marine environments. In particular, the book identifies knowledge gaps and recommends future research paths that may be taken. The book covers the current and emerging desalination processes, how environmental factors impact desalination operations and the historical and potential impacts of seawater desalination on the marine environment. This book is ideal as a reference for engineers and developers working towards mitigation and prevention of environmental impacts. In addition, scientists and researchers in environmental studies programs, as well as regulators and decision makers will find the data presented in the book to be useful as a guide for building and operating desalination plants. Provides a multidisciplinary approach to help readers understand the environmental impact of seawater desalination on the marine environment Presents environmental effects based on real data, helping the reader improve processes and mitigate effects Includes possible future effects, thus directing the reader towards important research issues

Solar Energy Desalination Technology

Elsevier **Solar Energy Desalination Technology** explains how to obtain clean water from sea water using solar energy. Special methods and types used in solar desalination are introduced, providing new thoughts, concepts, and feasible solutions in the desalination field, along with the thermal and economic efficiency relating to current technology. Many places in the world are suffering from fresh water shortage. However, those places are often rich with solar resources, sea water, and/or brackish water resources that could dramatically benefit from solar energy as a viable solution for

the production of fresh water. Explains the principles of solar thermal energy usage to produce clean water from sea water Introduces and explains new kinds of solar desalination systems, including their technical level and working principle Provides fundamental knowledge on water treatment and solar collection

Global Green Shift

When Ceres Meets Gaia

Anthem Press The world that created modern industry, pioneered in the West, is in decline. It is being transformed by a global green shift, creating new industries based on clean energy, clean water and clean food - all produced in a safe, clean and sustainable way, in abundance, at low (and diminishing) cost and without making further inroads into nature. This twenty-first century world is being driven by newly emerging industrial giants like China and India - just as the twentieth-century infrastructure of oil, automobiles and highways was created by the United States. It is China and India that are feeling the worst effects of industrializing along conventional 'business as usual' lines, and which have the greatest incentive to drive their own green shift. But the old world order based on a linear economy and fossil fuels is resisting bitterly, and will not give up without a fight. John A. Mathews explains how these trends and counter-trends are creating a new world order where an industrial system based on the Ceres (Circular Economy and Renewable Energy System) is seeking to take over from the world of fossil fuels, and provide scope for Gaia to become her wild self again. The outcome of this struggle is far from determined. It is the central issue to be resolved in the twenty-first century.

The Water, Food, Energy and Climate Nexus

Challenges and an agenda for action

Routledge Global trends of population growth, rising living standards and the rapidly increasing urbanized world are increasing the demand on water, food and energy. Added to this is the growing threat of climate change which will have huge impacts on water and food availability. It is increasingly clear that there is no place in an interlinked world for isolated solutions aimed at just one sector. In recent years the "nexus" has emerged as a powerful concept to capture these inter-linkages of resources and is now a key feature of policy-making. This book is one of the first to provide a broad overview of both the science behind the nexus and the implications for policies and sustainable development. It brings together contributions by leading intergovernmental and governmental officials, industry, scientists and other stakeholder thinkers who are working to develop the approaches to the Nexus of water-food-energy and climate. It represents a major synthesis and state-of-the-art assessment of the Nexus by major players, in light of the adoption by the United Nations of the new Sustainable Development Goals and Targets in 2015. With a foreword by HRH the Prince of Wales

The Green Economy in the Gulf

Routledge Filling a void in academic and policy-relevant literature on the topic of the green economy in the Arabian Gulf, this edited volume provides a multidisciplinary analysis of the key themes and challenges relating to the green economy in the region, including in the energy and water sectors and the urban environment, as well as with respect to cross-cutting issues, such as labour, intellectual property and South-South cooperation. Over the course of the book, academics and practitioners from various fields demonstrate why transitioning into a 'green economy' - a future economy based on environmental sustainability, social equity and improved well-being - is not an option but a necessity for the Gulf Cooperation Council (GCC) States. Through chapters covering key economic sectors and cross-cutting issues, the book examines the GCC states' quest to align their economies and economic development with the imperatives of environmental sustainability and social welfare, and proposes a way forward, based on lessons learned from experiences in the region and beyond. This volume will be of great relevance to scholars and policy makers with an interest in environmental economics and policy.

Bridging the Gulf: EU-GCC Relations at a Crossroads

Edizioni Nuova Cultura Relations between the European Union (EU) and the Gulf Cooperation Council (GCC) are at a crossroads. After the derailment of the negotiations for the Free Trade Agreement (FTA) in 2008, the cooperation between the two regional blocs has remained low-key in a number of different areas, while the unprecedented changes that have taken place in North Africa and the Middle East, the common neighbourhood of the EU and the GCC, have not led to a renewed, structured cooperation on foreign and security policy issues. This volume addresses the shortcomings and potential of EU-GCC relations by taking stock of their past evolution and by advancing policy recommendations as to how to revamp this strategic cooperation. In this light, it highlights the areas where greater room for manoeuvre exists in order to enhance EU-GCC relations, discusses the instruments available and sheds light on the features of the regional and international context that are likely to significantly influence the new phase in the mutual relation between the two blocs. The book is the result of the research conducted in the framework of the project 'Sharaka - Enhancing Understanding and Cooperation in EU-GCC Relations' co-funded by the European

Commission.

Water, Security and U.S. Foreign Policy

Taylor & Francis The prosperity and national security of the United States depend directly on the prosperity and stability of both partner and competing countries around the world. Today, U.S. interests are under rising pressure from water scarcity, extreme weather events and water-driven ecological change in key geographies of strategic interest to the U.S. Those water-driven stresses are undermining economic productivity, weakening governance systems and fraying social cohesion in scores of countries and, in the process, undermining the vitality of rural livelihoods, fostering local and ethnic conflicts, driving broad migratory movements and contributing to the growth of insurgencies and terrorist networks. While the U.S. intelligence community has steadily expanded natural resource concerns in their global threat analyses, our overseas development assistance remains locked into provision of water and hygienic services rather than responding to the full sweep of global water challenges including governance and policy failures, growing conflicts over water and the need for promoting sustainable transboundary water arrangements in partner countries. A fundamental departure from the past is urgently needed. Based on 18 case studies, *Water, Security and U.S. Foreign Policy* provides an analytical framework to help policy makers, scholars and researchers studying the intersection of U.S. foreign policy with the environment and sustainability issues, interpret the impacts of water-driven social disruptions on the stability of partner governments and U.S. interests abroad. The book also delivers specific recommendations to reorient U.S. development and diplomatic engagements that can forestall and prevent social disruptions and ensuing threats to U.S. prosperity and national security.

Global Innovation Index 2017

Innovation Feeding the World

WIPO The Global Innovation Index provides detailed metrics about the innovation performance of 127 countries and economies around the world. Its 81 indicators explore a broad vision of innovation, including political environment, education, infrastructure and business sophistication. This year's report reviews the state of innovation in agriculture and food systems across sectors and geographies. Chapters of the report provide more details on this year's theme from academic, business, and particular country perspectives from leading experts and decision makers.

Water Resources

A New Water Architecture

John Wiley & Sons Over 7 billion people demand water from resources that the changing climate is making more and more difficult to harness. Water scarcity and shortage are increasingly common and conditions are becoming more extreme. Inadequate and inappropriate management of water is already taking its toll on the environment and on the quality of life of millions of people. Modern water professionals have a duty to develop sound water science and robust evidence to lobby and influence national and regional development policy and investment priorities. We need to be bold and brave to challenge the status quo, argue the case for change, and create a New Water Architecture. *Water Resources: A New Water Architecture* takes a unique approach to the challenges of water management. The stress caused by our desire to live, eat, and consume is examined in the context of Governance, the role of policy, and the commercial world. The authors share their nine-step vision for a New Water Architecture. Written by three industry practitioners, this book provides students, young professionals, policymakers, and those interested in the sustainability of our natural resources with a pragmatic and compelling perspective on how to manage the ultimate resource of our time.

Water security and the sustainable development goals

UNESCO Publishing

The Handbook of Global Agricultural Markets

The Business and Finance of Land, Water, and Soft Commodities

Springer This book is a one-stop reference for practitioners and academics in finance, business and economics, providing a holistic reference to the international agriculture business. It takes a multidisciplinary approach, looking at the issues, opportunities and investable themes in the global agricultural space, combining research and practical tools.

Arab Water Security

Threats and Opportunities in the Gulf States

Cambridge University Press Exploring the national security implications of the Gulf states' reliance on desalination plants, this book provides the first systematic and comprehensive discussion of current and future threats to the supply of freshwater, effects of a potential disruption, and possible measures to increase resilience to these threats, for researchers and graduate students.

Sustainable Energy Technologies for Seawater Desalination

Academic Press Sustainable Energy Technologies for Seawater Desalination provides comprehensive coverage of the use of renewable energy technologies for sustainable freshwater production. Included are design concepts for desalination and sustainable energy technologies based on thermodynamics, heat transfer, mass transfer and economics. Key topics covered include desalination fundamentals and models, desalination assessments using energy and exergy methods, economics of desalination and the optimization of renewable energy-driven desalination systems. Illustrative examples and case studies are incorporated throughout the book to demonstrate how to apply the concepts covered in practical scenarios. Following a coherent approach, starting from fundamentals and basics and culminating with advanced systems and applications, this book is relevant for advanced undergraduate and graduate students in engineering and non-engineering programs. Provides a comprehensive resource on sustainable freshwater production Describes how to analyze renewable energy-based desalination using energy and exergy methods and economic assessments, and how to carry out performance optimization Incorporates numerous examples and case studies to illustrate practical applications Presents the most up-to-date information with recent developments

Water Resources and Integrated Management of the United Arab Emirates

Springer Nature This book provides an inventory of water resources, describes water challenges, and suggests methodologies and technologies for integrated water resources management in the UAE. It also summarizes efforts of water conservation and management, and modern approaches for improvement of water resources management and decision-making related to this valuable resource. The authors are specialized in geology and hydrogeology and have been teaching and conducting scientific research on water resources in the UAE for the last three decades. This book represents the main reference on water resources in the UAE for academia, researchers, professionals, students and the general public.

Handbook of Water Resources Management: Discourses, Concepts and Examples

Springer Nature This book provides an overview of facts, theories and methods from hydrology, geology, geophysics, law, ethics, economics, ecology, engineering, sociology, diplomacy and many other disciplines with relevance for concepts and practice of water resources management. It provides comprehensive, but also critical reading material for all communities involved in the ongoing water discourses and debates. The book refers to case studies in the form of boxes, sections, or as entire chapters. They illustrate success stories, but also lessons to be remembered, to avoid repeating the same mistakes. Based on consolidated state-of-the-art knowledge, it has been conceived and written to attract a multidisciplinary audience. The aim of this handbook is to facilitate understanding between the participants of the international water discourse and multi-level decision making processes. Knowing more about water, but also about concepts, methods and aspirations of different professional, disciplinary communities and stakeholders professionalizes the debate and enhances the decision making.

Progress Toward Sustainable Energy 2015

Global Tracking Framework Report

World Bank Publications Sustainable Energy for All seeks to improve the lives of billions of people across the world and ensure a more sustainable future by working to achieve its three global objectives: universal access to energy; doubling of the rate of improvement in energy efficiency; and doubling of the share of renewable energy in the global energy mix. Accountability and transparency are essential for tracking Sustainable Energy for All's global progress. Doing so will clarify where the initiative stands, how various actions are contributing to the three objectives, how much

remains to be accomplished, and where more action is needed to achieve Sustainable Energy For All. The first edition of the Global Tracking Framework (2013) provided a system for regular reporting, based on indicators that are technically rigorous and at the same time feasible to compute from current energy data bases, and that offer scope for progressive improvement over time. This second edition of the SE4ALL Global Tracking Framework provides an update of how the world has been moving towards the three objectives over the period 2010-2012. The report also explores a number of complementary themes. First, it provides further analysis of the financial cost of meeting the SE4ALL objectives as well as the geographical and technological distribution of the investments that need to be made. Second, it explores the extent to which countries around the world have access to the technology needed to make progress towards the three goals. Third, it identifies the improvements in data collection methodologies and capacity building that will be needed to provide a more nuanced and accurate picture of progress over time. Finally, this new edition of the Global Tracking Framework explores and introduces nexus concepts focusing on the links between energy and four priority areas of development: food, water, human health, and gender. Links between most of these areas and energy are well established, but often presented in isolation of each other.

Arab Sustainable Development Report

United Nations In September 2015, Governments worldwide adopted the 2030 Agenda for Sustainable Development, including 17 wide-ranging Sustainable Development Goals (SDGs). Using the SDGs as a thematic reference, the report examines progress on securing human dignity and well-being in the Arab countries and what is needed to achieve sustainable development in this region in turmoil. It also looks at the complex factors shaping the region: the occupation of Palestinian and other Arab lands; ongoing conflicts; governance, human rights and institutional deficits; and shortcomings in terms of financing, science and technology, trade and statistical capacity. The report stresses that urgent action is needed at the national and regional levels, and that integrated, long-term and evidence-based planning and investments that address the root causes of instability in the region are indispensable for achieving the SDGs.

ESCWA Water Development Report 6

The Water, Energy and Food Security Nexus in the Arab Region

United Nations This sixth issue of the ESCWA Water Development Report offers an analytical framework and a series of case studies for understanding the water-energy-food security nexus in the Arab region. The analytical framework considers the inter-linkages that affect the achievement of water security, energy security and food security through the lens of sustainable development and the achievement of the Sustainable Development Goals with a view to climate change and ensuring access to food, water and sustainable energy for all through a human rights approach to sustainable development.

Desalination Project Cost Estimating and Management

CRC Press Desalination Project Cost Estimating and Management examines the key issues associated with the estimation of costs for desalination plants. It covers all aspects of desalination project cost estimating and management: direct and indirect capital costs, fixed and variable operation and maintenance costs, and total costs for water production. In addition, it provides a detailed overview of the factors that influence project costs and discusses the technological and project delivery methods to control and optimize project costs. The book includes cost curves for the most commonly used seawater desalination facilities and numeric examples illustrating how to prepare a budgetary cost estimate for a typical desalination project. Features: •Presents a comprehensive engineering overview of key issues associated with desalination project cost estimating. •Includes cost curves which can be used for budgetary level estimates of capital, and operation and maintenance (O&M) expenditures. •Contains easy to use cost-estimating rules of thumb derived from actual desalination projects. •Includes several numeric examples illustrating the cost estimating process.

Renewable Energy Applications for Freshwater Production

CRC Press Worldwide, many regions have a great potential to cover part of their pressing water needs by renewable energy powered water treatment processes using either thermal or membrane based technologies. Not only arid and semiarid regions are increasingly suffering from water shortage but also many other regions face a limitation of freshwater resources either by increasing contamination of surface water bodies or groundwater resources unsuitable for drinking and irrigation purposes either due to their high grade of mineralization or their contents of toxic components. In many areas without centralized water supply, treatment techniques using locally available renewable energy resources such as wind, solar and geothermal can provide an economical, social and environmentally

sustainable option for clean water production from seawater and from highly mineralized or otherwise unsuitable ground- and surface water. This book provides an overview on possible cost-efficient techniques and application opportunities for different scales and shows why the implementation of these technologies faces numerous technological, economic and policy barriers and provides suggestions how they can be overcome. It serves as a synoptic compendium of the fundamentals of freshwater production using renewable energies, applicable to all types of water, ranging from brackish to marine water and also including industrial and communal residual water. The book is aimed at professionals, academics and decision makers worldwide, working in the areas of water resources, water supply, land planning, energy planning, greenhouse gases emission mitigation and rural development.

Energy For Water

Regional Case Studies

Routledge Water and energy are inextricably linked as unsound management of either resource can have an impact on the cost, availability, and sustainability of the other. This book explores the "energy for water" component of the water-energy nexus. It offers diverse case studies from around the world including the deserts of Saudi Arabia, rural China, Pakistan's Indus Basin, arid Greek islands, and urban centers such as Los Angeles. The analyses show that while many regions face unique water scarcity challenges, they are all united by the fact that solutions require mobilizing energy. This book focuses on how different policies and technologies are changing the way societies use energy to extract, treat, and transport water. In terms of policy, chapters explore how initiatives aimed at reducing demand for water and improved integrated resource planning can lead to energy savings. Regarding technology, case studies highlight the pros and cons of different methods of meeting water demand. Through exploring both technology and policy across a wide range of diverse case studies, the book offers a robust explanation of the "energy for water" side of the water-energy nexus equation, making it valuable reading for academics and policymakers. This book was originally published as a special issue as International Journal of Water Resources Development.

Renewable Energy Technologies

Advances and Emerging Trends for Sustainability

John Wiley & Sons RENEWABLE ENERGY TECHNOLOGIES With the goal of accelerating the growth of green energy utilization for the sustainability of life on earth, this volume, written and edited by a global team of experts, goes into the practical applications that can be utilized across multiple disciplines and industries, for both the engineer and the student. Green energy resources are gaining more attention in academia and industry as one of the preferred choices for sustainable energy conversion. Due to the energy demand, environmental impacts, economic needs, and social issues, green energy resources are being researched, developed, and funded more than ever before. Researchers are facing numerous challenges, but there are new opportunities waiting for green energy resource utilization within the context of environmental and economic sustainability. Efficient energy conversion from solar, wind, biomass, fuel cells, and others are paramount to this overall mission and the success of these efforts. Written and edited by a global team of experts, this groundbreaking new volume from Scrivener Publishing presents recent advances in the study of green energy across a variety of fields and sources. Various applications of green energy resources, modeling and performance analysis, and grid integration aspects of green energy resources are considered. Not only laying out the concepts in an easy-to-understand way, but this team offers the engineer, scientist, student, or other professional practical solutions to everyday problems in their daily applications. Valuable as a learning tool for beginners in this area as well as a daily reference for engineers and scientists working in these areas, this is a must-have for any library.

The Political and Economic Challenges of Energy in the Middle East and North Africa

Routledge The Middle East and North Africa (MENA) are in disarray, and shifts in the field of energy have the potential to drastically affect the course of political and economic developments in the region. Declining oil prices, skyrocketing domestic demand, the rise of unconventional oil and natural gas production in North America, as well as shifting patterns of global energy trade all put severe pressures on both producing and importing countries in the MENA region. Policy-makers are facing fundamental challenges in light of the duality of grand transformations in (geo)politics and energy. Changes in the field of energy require substantial political and economic reforms, affecting the very fabric of sociopolitical arrangements. At the same time, the MENA region's geopolitical volatility makes any such reforms extremely risky. Including contributions by academics and analysts from both inside and outside the MENA region, this volume explores the changes in global and regional energy, the impact of changing international energy dynamics on politics and economies in the MENA region, and the challenges that will result. This is essential reading for researchers, postgraduates, and professionals in Middle Eastern and North African politics, global energy governance and regionalism.

Gas Hydrate in Water Treatment

Technological, Economic, and Industrial Aspects

John Wiley & Sons GAS HYDRATE IN WATER TREATMENT Explores current progress in the expanding field of gas hydrate-based desalination As potable water shortages continue to affect billions of people worldwide, seawater desalination and wastewater treatment have the potential to meet freshwater demands in the near future. Gas hydrate-based desalination, a process which requires CO₂ and water as solvent, has become an increasingly popular approach—desalination with hydrates is environmentally friendly and can produce cheaper desalted water than other existing conventional technologies. *Gas Hydrate in Water Treatment: Technological, Economic, and Industrial Aspects* provides detailed, up-to-date reference to the application of gas hydrates in wastewater and seawater desalination treatment. Edited by experienced researchers in the field, this comprehensive volume describes the fundamental aspects of desalination and summarizes the latest research on gas hydrate-based desalination. The authors address a broad range of key topics, including issues related to water scarcity, post-treatment of desalinated water using both conventional and new technologies, hydrate-based desalination methods driven by renewable energy sources, and more. Provides thorough coverage of the technological, waste brine management, economic, and renewable energy and remineralization aspects of gas hydrate-based wastewater treatment Describes the energetic, economic, and environmental impact of gas hydrate desalination Explains the core concepts of gas hydrate-based desalination to help readers evaluate the performance of existing desalination processes Discusses the advantages and challenges of hydrate-based water treatment Compares conventional and gas hydrate technologies used in water treatment Reviews the most recent research in gas hydrate-based desalination *Gas Hydrate in Water Treatment: Technological, Economic, and Industrial Aspects* is an essential resource for all academics, researchers, process engineers, designers, industry professionals, and advanced students in the field.

Sustainable Entrepreneurship, Renewable Energy-Based Projects, and Digitalization

CRC Press Sustainable Entrepreneurship is nowadays considered as a discipline at the cross-roads of many others. This book describes recent cases, techniques and tools proposed for leaders, entrepreneurs, and practitioners who are involved and responsible for making strategic decisions in their companies and aiming at sustainable development. This book highlights the use of new business models/methods that can be employed by organizations and researchers to save millions of dollars, to enhance the economic growth, as well as to resolve environmental and social issues, via sustainable networks, renewal energy distribution, and social/green entrepreneurship. It will provide a comprehensive discussion of practical techniques, like Machine Learning, Robotics, Photovoltaic solar energy, in the field of renewable energy, and other digital tools, such as digital marketing, crowdsourcing platforms, and digital currency. Meanwhile, it will enlighten the way for entrepreneurs and decision makers by helping them to learn how to grow their business. The focus will be on how to benefit from these techniques to develop sustainable and renewable energy-based projects, as well as digitalized new ventures. The book walks the reader through the latest emerging trends in digitalization that can support practitioners, managers, entrepreneurs, and researchers to help them appreciate the application of sustainable solutions in various functional domains.

Modular Systems for Energy Usage Management

CRC Press "...[a] very unique book that integrates benefits of modular systems for enhanced sustainability to meet the global challenges of rapid and sometimes uncontrolled industrialization in the 21st century."—Pinakin Patel, T2M Global This book examines the role of the modular approach for the back end of the energy industry—energy usage management. It outlines the use of modular approaches for the processes used to improve energy conservation and efficiency, which are preludes to the prudent use of energy. Since energy consumption is conventionally broken down into four sectors—residential, transportation, industrial, and commercial—the discussions on energy usage management are also broken down into these four sectors in the book. The book examines the use of modular systems for five application areas that cover the sectors described above: buildings, vehicles, computers and electrical/electronic products, district heating, and wastewater treatment and desalination. This book also discusses the use of a modular approach for energy storage and transportation. Finally, it describes how the modular approach facilitates bottom-up, top-down, and hybrid simulation and modeling of the energy systems from various scientific and socioeconomic perspectives. Aimed at industry professionals and researchers involved in the energy industry, this book illustrates in detail, with the help of concrete industrial examples, how a modular approach can facilitate management of energy usage.

Solar Resources Mapping

Fundamentals and Applications

Springer This book presents methods for optimising the spatial and network configuration of solar radiation measuring stations. Various physical and mathematical models are demonstrated, which together with high quality measurements, provide the essential tools to generate and validate solar resource estimates to improve the mapping of solar resources. Each chapter deals with a specific topic, showing its methodology, and providing examples of how to apply these techniques with reference to current projects around the world. These topics include: · Radiometric measurement campaigns; · Equipment calibration, installation, operation, and maintenance; · Data quality assurance and assessment; · Solar radiation modelling from satellite images and numerical models; · Downscaling and kriging interpolation of solar radiation; · Simulation of electric solar power plant generation; · Solar radiation forecasting; · Applications of solar energy; and · Socio-economic benefits of solar energy. The contributors present the statistical and physical models needed to derive solar radiation from satellite images and numerical models, emphasising the importance of measuring solar radiation accurately. They also show the classical models used to generate synthetic data, clear sky models and ancillary air quality and meteorological data from different input sources. Solar Resources Mapping provides industry professionals with methodologies and tools to build solar irradiance maps for different applications. The book will also benefit students and researchers as it serves as a main technical reference, presenting the basic terminology and fundamentals for solar resource mapping that include methods for assessing measurement uncertainty.

The Energy-water Nexus

An Analysis and Comparison of Various Configurations Integrating Desalination with Renewable Power

Water stress is a worldwide reality. Planners and managers of water resources around the world are tasked with finding new, creative, and innovative solutions to challenges posed by growing populations and declining water supplies. Securing safe drinking water, however, has impacts beyond the water sector. In particular, the connection between energy and water must be carefully considered to avoid unwelcome increases in energy consumption as a result of new water management strategies. One strategy that is gaining increasing attention is desalination of brackish groundwater. However, desalination is an energy-intensive process and could have negative impacts in the energy sector if conventional approaches are used. Relying on fossil fuels for desalination could drive up carbon dioxide emissions associated with water treatment and increase the cost required to produce drinking water. Integrating desalination with renewable power sources such as wind and solar energy can mitigate concerns regarding the energy intensity of desalination. By coupling water treatment with non-carbon emitting sources of power, it is possible to meet growing water demands in a sustainable manner. At the same time, water production offers an opportunity to address problems associated with the intermittent nature of wind and solar power production. Desalination is a time-flexible process that pairs well with wind and solar power, two sources of energy that are limited in application by their daily and seasonal variability. Integrating desalination with wind and solar power offers a solution to energetic challenges of water production while using wind and solar power for desalination offers a solution to challenges associated with the intermittent nature of renewable power. Additionally, utilizing photovoltaic-thermal (PVT) solar modules in an integrated facility could be advantageous to both the water and solar power production processes. Brackish groundwater, which is at a relatively cool temperature, can be used to cool solar panels, which suffer from losses in efficiency associated with temperature increases. At the same time, solar panels can be used to preheat feed water, a process that reduces the energetic requirement for reverse osmosis desalination. Using the temperature difference between brackish groundwater and solar panels to an engineering advantage can be beneficial for the production of both solar power and drinking water. This thesis offers an investigation of desalination powered by wind and solar energy, including a study of a configuration using PVT solar panels. First, a water treatment was developed to estimate the power requirement for brackish groundwater reverse-osmosis (BWRO) desalination. Next, an energy model was designed to (1) size a wind farm based on this power requirement and (2) size a solar farm to preheat water before reverse osmosis treatment. Finally, an integrated model was developed that combines results from the water treatment and energy models. The integrated model uses optimization to simulate the performance of the proposed facility by maximizing daily operational profits. Results indicate that integrated facility can reduce grid-purchased electricity costs by 88% during summer months and 89% during winter when compared to a stand-alone desalination plant. Additionally, the model suggests that the integrated configuration can generate \$574 during summer and \$252 from sales of wind- and solar-generated electricity to supplement revenue from water production. These results indicate that an integrated facility combining desalination, wind power, and solar power can potentially reduce reliance on grid-purchased electricity and advance the use of renewable power. In addition, this analysis fills a knowledge gap in understanding the advantages and tradeoffs between using wind power, solar power, and a combination of wind and solar power for desalination. By providing insight into the potential operations of an integrated facility, the investigation discussed in this report aids to the understanding of the water-energy nexus associated with new sources of drinking water. Results from this thesis indicate that integrating desalination with renewable power provides an opportunity for collaboration that can be mutually beneficial to both the water and

energy sectors. In particular combining desalination, wind power, and solar power can overcome challenges associated with each of these technologies and may be preferable to stand-alone water or power producing facilities.

Desalination Sustainability

A Technical, Socioeconomic, and Environmental Approach

Elsevier Desalination Sustainability: A Technical, Socioeconomic, and Environmental Approach presents a technical, socioeconomical, and environmental approach that guides researchers and technology developers on how to quantify the energy efficiency of a proposed desalination process using thermodynamics-based tools. The book offers the technical reader an understanding of the issues related to desalination sustainability. For example, technology users, such as public utility managers will gain the ability and tools to assess whether or not desalination is a good choice for a city or country. Readers will learn new insights on a clear and practical methodology on how to probe the economic feasibility of desalination using simple and effective tools, such as levelized cost of water (LCOW) calculation. Decision-makers will find this book to be a valuable resource for the preliminary assessment of whether renewable-powered desalination is a good choice for their particular setting. Presents the issues related to desalination sustainability Guides researchers and technology developers on how to quantify the energy efficiency of a proposed desalination process using thermodynamics-based tools Outlines a clear and practical methodology on how to probe the economic feasibility of desalination using simple and effective tools Provides a roadmap for decision-makers on the applicability of a desalination process at a particular setting

Emerging Membrane Technology for Sustainable Water Treatment

Elsevier Emerging Membrane Technology for Sustainable Water Treatment provides the latest information on the impending crisis posed by water stress and poor sanitation, a timely issue that is one of the greatest human challenges of the 21st century. The book also discusses the use of membrane technology, a serious contender that can be used to confront the crisis on a global scale, along with its specific uses as a solution to this escalating problem. Provides a unique source on membrane technology and its application for water treatment Focuses on technologies designed for the treatment of seawater and brackish water Highlights the most economically and environmentally friendly membrane technologies Lists various technologies and emphasizes their link to renewable energy, energy efficiency, nanotechnology, reuse, and recycle