21st Century Cellulosic Ethanol Biomass And Biofuels Wood Chips Stalks Switchgrass Plant Products Feedstocks Cellulose Conversion Processes Research Plans

Alcohol fuels must remain as an essential component for the realization of a sustainable low-carbon society. Use of locally available, under-utilized feedstock becomes important for local energy security as well as an option for distributed energy infrastructure. Utilizing the available feedstock that has not been properly regarded as a legitimate resource due to economic and social reasons should be the focal point in the search for possible resources for alcohol fuels. Lignocellulosic biomass and algal species are feedstocks that suit the purpose. This book can provide a brief introduction regarding the recent advances in the alcohol fuel field that is in constant challenge from recent issues on CO2, shale oil, power-to-gas, and hydrogen.

One of the greatest challenges facing our environment today is pollution and carbon emissions from our increasing demand for energy. Also faced with finite fossil fuel sources, renewable energy technologies are being developed to be

sustainable both in their source and for our environment. This book discusses the history of alternative and renewable energy sources, such as wind, wave, and solar power, through to cutting-edge developments, including their technological, social, and economic challenges.

Sorghum is the most important cereal crop grown in the semi-arid tropics (SAT) of Africa, Asia, Australia and Americas for food, feed, fodder and fuel. It is the fifth most important cereal crop globally after rice, wheat, maize and barley, and plays a major role in global food security. Sorghum is consumed in different forms for various end-uses. Its grain is mostly used directly for food purposes. After the release of the proceedings of two international symposia in the form of books “Sorghum in Seventies” and “Sorghum in Eighties”, global sorghum research and development have not been documented at one place. Of course, few books on sorghum have been released that focus on specific issues/research areas, but comprehensive review of all aspects of recent development in different areas of sorghum science has not been compiled in the form a single book. This book is intended to fill in a void to bridge the gap by documenting all aspects of recent research and development in sorghum encompassing all the progress made, milestones achieved across globe in genetic diversity assessment, crop improvement and production, strategies for high yield, biotic and abiotic stress

resistance, grain and stover quality aspects, storage, nutrition, health and industrial applications, biotechnological applications to increase production, including regional and global policy perspectives and developmental needs. This book will be an institutional effort to compile all the latest information generated in research and development in sorghum across the globe at one place.

This book comprises research studies of novel work on combustion for sustainable energy development. It offers an insight into a few viable novel technologies for improved, efficient and sustainable utilization of combustion-based energy production using both fossil and bio fuels. Special emphasis is placed on micro-scale combustion systems that offer new challenges and opportunities. The book is divided into five sections, with chapters from 3-4 leading experts forming the core of each section. The book should prove useful to a variety of readers, including students, researchers, and professionals.

Introduction to Chemicals from Biomass, Second Edition presents an overview of the use of biorenewable resources in the 21st century for the manufacture of chemical products, materials and energy. The book demonstrates that biomass is essentially a rich mixture of chemicals and materials and, as such, has a tremendous potential as feedstock for making a wide range of chemicals and materials with applications in industries from pharmaceuticals to furniture.

Completely revised and updated to reflect recent developments, this new edition begins with an introduction to the biorefinery concept, followed by chapters addressing the various types of available biomass feedstocks, including waste, and the different pre-treatment and processing technologies being developed to turn these feedstocks into platform chemicals, polymers, materials and energy. The book concludes with a discussion on the policies and strategies being put in place for delivering the so-called Bioeconomy. Introduction to Chemicals from Biomass is a valuable resource for academics, industrial scientists and policy-makers working in the areas of industrial biotechnology, biorenewables, chemical engineering, fine and bulk chemical production, agriculture technologies, plant science, and energy and power generation. We need to reduce our dependence on fossil resources and increasingly derive all the chemicals we take for granted and use in our daily life from biomass – and we must make sure that we do this using green chemistry and sustainable technologies! For more information on the Wiley Series in Renewable Resources, visit www.wiley.com/go/rrs Topics covered include: • The biorefinery concept • Biomass feedstocks • Pre-treatment technologies • Platform molecules from renewable resources • Polymers from bio-based monomers • Biomaterials • Bio-based energy production Praise for the 1st edition: “Drawing on the expertise of the authors the book involves a degree

of plant biology and chemical engineering, which illustrates the multidisciplinary nature of the topic beautifully" - Chemistry World

The impact of energy on global security and economy is clear and profound, and this is why in recent years energy security has become a source of concern to most countries. However, energy security means different things to different countries based on their geographic location, their endowment of resources their strategic and economic conditions. In this book, Gal Luft and Anne Korin with the help of twenty leading experts provide an overview of the world's energy system and its vulnerabilities that underlay growing concern over energy security. It hosts a debate about the feasibility of resource conflicts and covers issues such as the threat of terrorism to the global energy system, maritime security, the role of multinationals and non-state actors in energy security, the pathways to energy security through diversification of sources and the development of alternative energy sources. It delves into the various approaches selected producers, consumers and transit states have toward energy security and examines the domestic and foreign policy tradeoffs required to ensure safe and affordable energy supply. The explains the various pathways to energy security and the tradeoffs among them and demonstrates how all these factors can be integrated in a larger foreign and domestic policy framework. It also explores the future of

nuclear power, the complex relations between energy security and environmental concerns and the role for decentralized energy as a way to enhance energy security.

A compendium of current knowledge about conventional and alternative sources of energy. It clarifies complex technical issues, enlivens history, and illuminates the policy dilemmas we face today. This revised edition includes new material on biofuels, an expanded section on sustainability and sustainable energy, and updated figures and tables throughout. There are also online instructor materials for those professors who adopt the book for classroom use.

One of the great technological issues of this 21st century involves the effort of man to manage climate change through the reduction of fossil-fuel consumption. Part of this plan calls for the gradually replacement of petroleum refineries with biorefineries that use biomass as its renewable feedstock. Lignocellulosic biomass represents a huge potential reservoir for the production of renewable energy, chemicals and materials, which could have a significant impact in our society's efforts to manage greenhouse gas emissions while reducing petroleum consumption. The book describes the current status, development, and future prospects for the critical technology of second-generation biorefineries, specifically with a focus on lignocellulosic materials as feedstock. The book will

primarily serve scientists and engineers in chemistry and biochemistry, working both in academia and in industry. But with its careful development of the main points, and many dozens of color illustrations, it is also accessible to a broader public, such as policy makers and students.

Biomass, translated into English for the first time, introduced the world to China's development of bioenergy in the turn of the 21st century and proposed further development of bioenergy as well. Businessmen, scientists, and technicians alike who are interested in bioenergy will find a great deal of information within this book.

"Fossil fuels were in the last century the main source of fuels and raw materials for the standard life pattern of modern society. Their depletion together with huge environmental damage to earth derived from their combustion turn the change to renewable raw materials an urgent goal. This conversion is now underway and it requires a big effort to adapt materials Nature designed for specific purposes to fit in others. Evidences emerge that goals such as cellulosic ethanol are more difficult to take under competitive context, making its delay inevitable. Biomass composition is mainly hemicellulose, cellulose and lignin - the first two have a sugar origin - in their polymer form substances such as microcrystalline cellulose and carbon fiber may be obtained and there is an increasing demand for goods

made with which tend to raise in future"--

Frontiers in Bioenergy and Biofuels presents an authoritative and comprehensive overview of the possibilities for production and use of bioenergy, biofuels, and coproducts. Issues related to environment, food, and energy present serious challenges to the success and stability of nations. The challenge to provide energy to a rapidly increasing global population has made it imperative to find new technological routes to increase production of energy while also considering the biosphere's ability to regenerate resources. The bioenergy and biofuels are resources that may provide solutions to these critical challenges. Divided into 25 discreet parts, the book covers topics on characterization, production, and uses of bioenergy, biofuels, and coproducts. Frontiers in Bioenergy and Biofuels provides an insight into future developments in each field and extensive bibliography. It will be an essential resource for researchers and academic and industry professionals in the energy field.

This book provides a timely and insightful analysis of the expansion of biofuels production and use in recent years. Drawing on interviews with key policy insiders, Ackrill and Kay show how biofuels policies have been motivated by concerns over climate change, energy security and rural development.

What role will biofuels play in the scientific portfolio that might bring energy

independence and security, revitalize rural infrastructures, and wean us off of our addiction to oil? The shifting energy landscape of the 21st century, with its increased demand for renewable energy technology, poses a worrying challenge. Discussing the multidisciplin

Biofuels are a much-needed sustainable energy source. Readers are introduced to this great source, which is plant and animal waste. Biofuel options, including biogas, ethanol, and biodiesel are fully explored. Related issues are also discussed, such as social and economic costs.

This book aspires to be a comprehensive summary of current biofuels issues and thereby contribute to the understanding of this important topic. Readers will find themes including biofuels development efforts, their implications for the food industry, current and future biofuels crops, the successful Brazilian ethanol program, insights of the first, second, third and fourth biofuel generations, advanced biofuel production techniques, related waste treatment, emissions and environmental impacts, water consumption, produced allergens and toxins. Additionally, the biofuel policy discussion is expected to be continuing in the foreseeable future and the reading of the biofuels features dealt with in this book, are recommended for anyone interested in understanding this diverse and developing theme.

Sets the stage for the development of sustainable, environmentally friendly fuels, chemicals, and materials Taking millions of years to form, fossil fuels are nonrenewable resources; it is estimated that they will be depleted by the end of this century. Moreover, the production and use of fossil fuels have resulted in considerable environmental harm. The generation of environmentally friendly energy from renewable sources such as biomass is therefore essential. This book focuses on the integration of green chemistry concepts into biomass processes and conversion in order to take full advantage of the potential of biomass to replace nonsustainable resources and meet global needs for fuel as well as other chemicals and materials. The Role of Green Chemistry in Biomass Processing and Conversion features contributions from leading experts from Asia, Europe, and North America. Focusing on lignocellulosic biomass, the most abundant biomass resource, the book begins with a general introduction to biomass and biorefineries and then provides an update on the latest advances in green chemistry that support biomass processing and conversion. Next, the authors describe current and emerging biomass processing and conversion techniques that use green chemistry technologies, including: Green solvents such as ionic liquids, supercritical CO2, and water Sustainable energy sources such as microwave irradiation and sonification Green catalytic technologies

Advanced membrane separation technologies The last chapter of the book explores the ecotoxicological and environmental effects of converting and using fuels, chemicals, and materials from biomass. Recommended for professionals and students in chemical engineering, green chemistry, and energy and fuels, The Role of Green Chemistry in Biomass Processing and Conversion sets a strong foundation for the development of a competitive and sustainable bioeconomy. This monograph includes a Foreword by James Clark (University of York, UK).

A comprehensive examination of the large number of possible pathways for converting biomass into fuels and power through thermochemical processes Bringing together a widely scattered body of information into a single volume, this book provides complete coverage of the many ways that thermochemical processes are used to transform biomass into fuels, chemicals and power. Fully revised and updated, this new edition highlights the substantial progress and recent developments that have been made in this rapidly growing field since publication of the first edition and incorporates up-to-date information in each chapter. Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition incorporates two new chapters covering: condensed phased reactions of thermal deconstruction of biomass and life cycle analysis of thermochemical processing systems. It offers a new introductory chapter

that provides a more comprehensive overview of thermochemical technologies. The book also features fresh perspectives from new authors covering such evolving areas as solvent liquefaction and hybrid processing. Other chapters cover combustion, gasification, fast pyrolysis, upgrading of syngas and bio-oil to liquid transportation fuels, and the economics of thermochemically producing fuels and power, and more. Features contributions by a distinguished group of European and American researchers offering a broad and unified description of thermochemical processing options for biomass Combines an overview of the current status of thermochemical biomass conversion as well as engineering aspects to appeal to the broadest audience Edited by one of Biofuels Digest's "Top 100 People" in bioenergy for six consecutive years Thermochemical Processing of Biomass: Conversion into Fuels, Chemicals and Power, 2nd Edition will appeal to all academic researchers, process chemists, and engineers working in the field of biomass conversion to fuels and chemicals. It is also an excellent book for graduate and advanced undergraduate students studying biomass, biofuels, renewable resources, and energy and power generation.

From its humble beginning in the late 19th centurywhen Henry Ford's first car was designed to run on ethanolbiofuel production has been on the rise with more than 26 billion liters produced in the U.S. in 2007. Ethanol made from biomass (rather than grains) holds great promise, including numerous economic and environmental benefits. However, the ad

This book investigates the main vegetable biomass types, their chemical characteristics and their potential to replace oil as raw material for the chemical industry, according to the principles of green chemistry. Authors from different scientific and technical backgrounds, from industry and academia, give an overview of the state of the art and ongoing developments. Aspects including bioeconomy, biorefineries, renewable chemistry and sustainability are also considered, given their relevance in this context. Furthermore, the book reviews green chemistry principles and their relation to biomass, while also exploring the main processes for converting biomass into bioproducts. The need to develop renewable feedstock for the chemical industry to replace oil has been identified as a major strategic challenge for the 21st century. In this context, the use of different types of vegetable biomass – starch, lignocellulosic, oleaginous, saccharide and algae – can be seen as a viable alternative to the use of non-renewable, more expensive raw materials. Furthermore, it offers a model for adding economic value to the agro industrial chains such as soybean, sugarcane, corn and forests, among others. This will in turn contribute to the sustainability of a wide range of chemicals, mainly organics and their transformation processes, which are widely used by modern society. This paper examines the potential role of large scale, dedicated commercial biomass energy systems under global climate policies designed to stabilize atmospheric concentrations of CO2 at 400ppm and 450ppm. We use an integrated assessment model of energy and agriculture systems to show that, given a climate policy in which

terrestrial carbon is appropriately valued equally with carbon emitted from the energy system, biomass energy has the potential to be a major component of achieving these low concentration targets. The costs of processing and transporting biomass energy at much larger scales than current experience are also incorporated into the modeling. From the scenario results, 120-160 EJ/year of biomass energy is produced by midcentury and 200-250 EJ/year by the end of this century. In the first half of the century, much of this biomass is from agricultural and forest residues, but after 2050 dedicated cellulosic biomass crops become the dominant source. A key finding of this paper is the role that carbon dioxide capture and storage (CCS) technologies coupled with commercial biomass energy can play in meeting stringent emissions targets. Despite the higher technology costs of CCS, the resulting negative emissions used in combination with biomass are a very important tool in controlling the cost of meeting a target, offsetting the venting of CO2 from sectors of the energy system that may be more expensive to mitigate, such as oil use in transportation. The paper also discusses the role of cellulosic ethanol and Fischer-Tropsch biomass derived transportation fuels and shows that both technologies are important contributors to liquid fuels production, with unique costs and emissions characteristics. Through application of the GCAM integrated assessment model, it becomes clear that, given CCS availability, bioenergy will be used both in electricity and transportation.

In the United States, we have come to depend on plentiful and inexpensive energy to

support our economy and lifestyles. In recent years, many questions have been raised regarding the sustainability of our current pattern of high consumption of nonrenewable energy and its environmental consequences. Further, because the United States imports about 55 percent of the nation's consumption of crude oil, there are additional concerns about the security of supply. Hence, efforts are being made to find alternatives to our current pathway, including greater energy efficiency and use of energy sources that could lower greenhouse gas (GHG) emissions such as nuclear and renewable sources, including solar, wind, geothermal, and biofuels. The United States has a long history with biofuels and the nation is on a course charted to achieve a substantial increase in biofuels. Renewable Fuel Standard evaluates the economic and environmental consequences of increasing biofuels production as a result of Renewable Fuels Standard, as amended by EISA (RFS2). The report describes biofuels produced in 2010 and those projected to be produced and consumed by 2022, reviews model projections and other estimates of the relative impact on the prices of land, and discusses the potential environmental harm and benefits of biofuels production and the barriers to achieving the RFS2 consumption mandate. Policy makers, investors, leaders in the transportation sector, and others with concerns for the environment, economy, and energy security can rely on the recommendations provided in this report.

Food Industry Wastes: Assessment and Recuperation of Commodities presents

emerging techniques and opportunities for the treatment of food wastes, the reduction of water footprint, and creating sustainable food systems. Written by a team of experts from around the world, this book provides a guide for implementing bioprocessing techniques. It also helps researchers develop new options for the recuperation of these wastes for community benefit. More than 34 million tons of food waste was generated in the United States in 2009, at a cost of approximately $43 billion. And while less than three percent of that waste was recovered and recycled, there is growing interest and development in recovering and recycling food waste. These processes have the potential not only to reduce greenhouse gases, but to provide energy and resources for other purposes. This book examines these topics in detail, starting with sources, characterization and composition of food wastes, and development of green production strategies. The book then turns to treatment techniques such as solid-state fermentation and anaerobic digestion of solid food waste for biogas and fertilizer. A deep section on innovative biocatalysts and bioreactors follows, encompassing hydrogen generation and thermophilic aerobic bioprocessing technologies. Rounding out the volume are extensive sections on water footprints, including electricity generation from microbial fuel cells (MFCs), and life cycle assessments. Food waste is an area of focus for a wide range of related industries from food science to energy and engineering Outlines the development of green product strategies International authoring team represents the leading edge in research and development Highlights

leading trends of current research as well as future opportunities for reusing food waste
The U.S. Department of Energy (DOE) promotes scientific and technological innovation to advance the national, economic, and energy security of the United States. Recognizing the potential of microorganisms to offer new energy alternatives and remediate environmental contamination, DOE initiated the Genomes to Life program, now called Genomics: GTL, in 2000. The program aims to develop a predictive understanding of microbial systems that can be used to engineer systems for bioenergy production and environmental remediation, and to understand carbon cycling and sequestration. This report provides an evaluation of the program and its infrastructure plan. Overall, the report finds that GTL's research has resulted in and promises to deliver many more scientific advancements that contribute to the achievement of DOE's goals. However, the DOE's current plan for building four independent facilities for protein production, molecular imaging, proteome analysis, and systems biology sequentially may not be the most cost-effective, efficient, and scientifically optimal way to provide this infrastructure. As an alternative, the report suggests constructing up to four institute-like facilities, each of which integrates the capabilities of all four of the originally planned facility types and focuses on one or two of DOE's mission goals. The alternative infrastructure plan could have an especially high ratio of scientific benefit to cost because the need for technology will be directly tied to the biology goals of the program.

What does cotton candy, which dissolves at the touch, have in common with Kevlar, used for bullet-proof vests? How can our understanding of such materials help us to tackle essential problems of the 21st century? Materials play a key role in our search for solutions to many pressing issues. They underpin many industries, are critical for the development of consumer goods, are essential components of medical diagnostic techniques, offer hope for the treatment of currently incurable diseases, and provide answers to environmental problems. This handbook is a guide to the materials we rely on for the future. Materials for the 21st Century serves as a useful resource for undergraduate and high school students preparing for a career in physical sciences, life sciences,or engineering, by helping them to identify new areas of interest. It is also an excellent reference for readers interested in learning more about the diverse range of materials that underlie key aspects of our economy and everyday lives.

The 21st Century Truck Partnership (21CTP) works to reduce fuel consumption and emissions, increase heavy-duty vehicle safety, and support research, development, and demonstration to initiate commercially viable products and systems. This report is the third in a series of three by the National Academies of Sciences, Engineering, and Medicine that have reviewed the research and development initiatives carried out by the 21CTP. Review of the 21st Century Truck Partnership, Third Report builds on the Phase 1 and 2 reviews and reports, and also comments on changes and progress since the Phase 2 report was issued in 2012.

Bioethanol has been recognized as a potential alternative to petroleum-derived transportation fuels. Even if cellulosic biomass is less expensive than corn and sugarcane, the higher costs

for its conversion make the near-term price of cellulosic ethanol higher than that of corn ethanol and even more than that of sugarcane ethanol. Conventional process for bioethanol production from lignocellulose includes a chemical/physical pre-treatment of lignocellulose for lignin removal, mostly based on auto hydrolysis and acid hydrolysis, followed by saccharification of the free accessible cellulose portions of the biomass. The highest yields of fermentable sugars from cellulose portion are achieved by means of enzymatic hydrolysis, currently carried out using a mix of cellulases from the fungus Trichoderma reesei. Reduction of (hemi)cellulases production costs is strongly required to increase competitiveness of second generation bioethanol production. The final step is the fermentation of sugars obtained from saccharification, typically performed by the yeast Saccharomyces cerevisiae. The current process is optimized for 6-carbon sugars fermentation, since most of yeasts cannot ferment 5-carbon sugars. Thus, research is aimed at exploring new engineered yeasts abilities to co-ferment 5- and 6-carbon sugars. Among the main routes to advance cellulosic ethanol, consolidate bio-processing, namely direct conversion of biomass into ethanol by a genetically modified microbes, holds tremendous potential to reduce ethanol production costs. Finally, the use of all the components of lignocellulose to produce a large spectra of biobased products is another challenge for further improving competitiveness of second generation bioethanol production, developing a biorefinery.

Advanced Technology for the Conversion of Waste into Fuels and Chemicals: Volume 1: Biological Processes presents advanced and combined techniques that can be used to convert waste to energy, including combustion, gasification, paralysis, anaerobic digestion and fermentation. The book focuses on solid waste conversion to fuel and energy and presents the

latest advances in the design, manufacture, and application of conversion technologies. Contributors from the fields of physics, chemistry, metallurgy, engineering and manufacturing present a truly trans-disciplinary picture of the field. Chapters cover important aspects surrounding the conversion of solid waste into fuel and chemicals, describing how valuable energy can be recouped from various waste materials. As huge volumes of solid waste are produced globally while huge amounts of energy are produced from fossil fuels, the technologies described in this comprehensive book provide the information necessary to pursue clean, sustainable power from waste material. Presents the latest advances in waste to energy techniques for converting solid waste to valuable fuel and energy Brings together contributors from physics, chemistry, metallurgy, engineering and the manufacturing industry Includes advanced techniques such as combustion, gasification, paralysis, anaerobic digestion and fermentation Goes far beyond municipal waste, including discussions on recouping valuable energy from a variety of industrial waste materials Describes how waste to energy technologies present an enormous opportunity for clean, sustainable energy

Our Energy Future is an introductory textbook for the study of energy production, alternative and renewable fuels, and ways to build a sustainable energy future. Jones and Mayfield explore the creation and history of fossil fuels, their impact on the environment, and how they have become critical to our society. The authors also outline how adopting sustainable biofuels will be key to the future of energy stability and discuss a number of renewable energy options and biofuel feedstocks that are replacements for petroleum-based products. Our society is consuming energy at an alarming rate, and the authors warn that continuing fuel-usage patterns could permanently damage the environment. This book emphasizes the importance of

continued scientific, agricultural, and engineering development while it outlines the political and environmental challenges that will accompany a complete shift from fossil fuels to renewable energy and biomass. Our Energy Future is an accessible resource for undergraduate students studying biofuels and bioenergy.

This volume explores the complex interrelationships between food and agriculture, politics, and society. More specifically, it considers the political aspects of three basic economic questions: what is to be produced? how is it to be produced? how it is to be distributed? It also outlines three unifying themes running through the politics of answering these societal questions with regard to food, namely: ecology, technology and property.

Current Status and Future Scope of Microbial Cellulases not only explores the present and future of cellulase production, it also compares solid state fermentation (SSF) and submerged fermentation (SMF) for cellulase production. Chapters explore bioprocess engineering, metabolic engineering and genetic engineering approaches for enhanced cellulase production, including the application of cellulase for biofuel production. This important resource presents current technical status and the future direction of advances in cellulase production, including application of cellulases in different sectors. Covers the present industrial scenarios and future prospect of cellulase production Describes the molecular structure of cellulase Explores genetic engineering, metabolic engineering and other approaches for improved cellulase production Includes different applications of cellulases, including their application in the bioenergy sector

Comprehensive coverage on the growing science and technology of producing ethanol from the world's abundant cellulosic biomass The inevitable decline in petroleum reserves and its

impact on gasoline prices, combined with climate change concerns, have contributed to current interest in renewable fuels. Bioethanol is the most successful renewable transport fuel—with corn and sugarcane ethanol currently in wide use as blend-in fuels in the United States, Brazil, and a few other countries. However, there are a number of major drawbacks in these first-generation biofuels, such as their effect on food prices, net energy balance, and poor greenhouse gas mitigation. Alternatively, cellulosic ethanol can be produced from abundant lignocellulosic biomass forms such as agricultural or municipal wastes, forest residues, fast growing trees, or grasses grown in marginal lands, and should be producible in substantial amounts to meet growing global energy demand. The Handbook of Cellulosic Ethanol covers all aspects of this new and vital alternative fuel source, providing readers with the background, scientific theory, and recent research progress in producing cellulosic ethanol via different biochemical routes, as well as future directions. The seventeen chapters include information on: Advantages of cellulosic ethanol over first-generation ethanol as a transportation fuel Various biomass feedstocks that can be used to make cellulosic ethanol Details of the aqueous phase or cellulolysis route, pretreatment, enzyme or acid saccharification, fermentation, simultaneous saccharification fermentation, consolidated bioprocessing, genetically modified microorganisms, and yeasts Details of the syngas fermentation or thermochemical route, gasifiers, syngas cleaning, microorganisms for syngas fermentation, and chemical catalysts for syngas-to-ethanol conversion Distillation and dehydration to fuel-grade ethanol Techno-economical aspects and the future of cellulosic ethanol Readership Chemical engineers, chemists, and technicians working on renewable energy and fuels in industry, research institutions, and universities. The Handbook can also be used by students

interested in biofuels and renewable energy issues.

"Forage Cell Wall Structure and Digestibility presents the findings of more than 160 researchers from around the world who specialize in disciplines ranging from plant cell wall chemistry to digestibility. The authors review the various aspects of forage cell wall structure and digestibility and provide not only the latest information, but also a vision of future opportunities for research. "

This book takes a very close look at energy and energy security from a hands-on, technical point of view with an ultimate goal of sorting out and explaining the deep meaning of energy as well as the key factors and variables of our energy security. The book reviews the major energy sources—coal, crude oil, natural gas, the renewables, and other alternative fuels and technologies—according to the way they affect our energy security now and what consequences might be expected in the future. Topics include the different technical, logistics, regulatory, social, political, and financial aspects of modern energy products and technologies. The advantages and disadvantages of the different fuels, technologies, energy strategies, regulations, and policies are reviewed in detail, sorted, and clearly laid out as well as their effects on our present and future energy security in a way that is easy to understand by high school students, engineers, and professors alike. This book is a must-read for energy executives, environmental specialists, investors, bankers, lawyers, regulators, politicians, and anyone involved, or interested, in today’s energy production and use and their effects on our energy security.

These volumes convey what daily life is like in the Middle East, Asia and Africa. Entries will aid readers in understanding the importance of cultural sociology, to appreciate the effects of cultural forces around the world.

Global Bioethanol: Evolution, Risks, and Uncertainties explores the conceptual and methodological approaches for the understanding of bioethanol technologies, policies and future perspectives. After a decade of huge investments made by big companies and governments all around the world, it is time to talk about the real conditions in which bioethanol will (or will not) evolve. Uncertainties and certainties are discussed and addressed to understand the futures of global bioethanol. The book analyses the evolution of bioethanol in the world's energy mix under technological, economic and commercial perspectives. It gives particular emphasis on the innovative trajectories of second-generation ethanol and their potential in different countries and regions. Future scenarios are proposed in order to evaluate the possible outcomes of ethanol in a global perspective. For providing a thorough overview of the bioethanol sector from different points of view, this book is a very useful resource for all involved with biofuels in general and bioethanol in particular, including energy engineers, researchers, consultants, analysts and policy makers. Presents a thorough examination of the uncertainties surrounding bioethanol in the future global energy mix Provides a data-driven and updated picture on the technological, economic, and market trends and scenarios for bioethanol Offers a foresight analysis on the perspectives of bioethanol as

a global commodity Includes a prospective about who is going to lead the new trajectories in the global arena

The development of a domestic biofuel industry has been a major policy thrust of the United States federal government in the first decade of the 21st century. Cellulosic biofuels have been identified as the primary candidate for meeting long term sustainability and energy security goals. In this thesis potential cellulosic biofuels produced via thermochemical processing are analyzed. Thermochemical processing utilizes well established chemical synthesis technology and allows for both feedstock and product flexibility relative to traditional enzymatic biofuel production routes. In this thesis both Spark Ignition Engine fuels (Methanol, Ethanol, Mixed Alcohols, and Methanol-to-Gasoline Synthetic Gasoline) and Compression Ignition Engine fuels (Dimethyl Ether and Fischer-Tröpsch Diesel). The abovementioned fuels are analyzed on a lifecycle basis with respect to identified criteria affecting each fuels adoptability including: (1) energy efficiency, (2) cost of production and shipping, (3) integrability into the current distribution infrastructure and (4) compatibility with regulatory and policy landscape. A primary conclusion from this analysis is that no one fuel is optimal with respect to all metrics. Instead, it is likely that a variety of fuels should be employed for different applications. The US biofuel policy landscape is also analyzed in this thesis. It is found that the criteria above are not currently weighed in fuel adoption policies and instead parochial interests have carried more weight in the development of the US

biofuel industry in which ethanol is the de facto fuel of choice. Therefore, it is likely to be difficult for a non-ethanol cellulosic biofuel industry to develop without major policy changes.

As the world's population is projected to reach 10 billion or more by 2100, devastating fossil fuel shortages loom in the future unless more renewable alternatives to energy are developed. Bioenergy, in the form of cellulosic biomass, starch, sugar, and oils from crop plants, has emerged as one of the cheaper, cleaner, and environmentally sustainab

The aviation industry is committed to reducing its environmental impact and has established the ambitious goals to reach carbon neutral growth by 2020 and to reduce carbon dioxide emissions by 50% (from 2005 levels) by 2050. Currently, the aviation industry generates approximately 2% of man-caused carbon dioxide emissions; it is a small but growing share that is projected to reach 3% by 2030. BOEING and EMBRAER, as leading aviation companies committed to a more sustainable future, have joined efforts to support initiatives to lower greenhouse gas (GHG) emissions derived from air transportation. These emissions represent an important global concern in the 21st century, and the growing aviation industry will need to find ways to reduce its contribution, particularly in substituting fossil fuels by sustainable biofuel. Airlines are doing their part as well. Globally, they have created the Sustainable Aviation Fuel Users Group (SAFUG), an organization focused on accelerating the development and

commercialization of sustainable aviation biofuels and representing about 30% of commercial jet fuel demand. Brazil is internationally recognized for its long experience of using biomass for energy purposes beginning with wood, sugarcane ethanol, and biodiesel. Modern bioenergy represents around 30% of the Brazilian energy matrix, and has a long track record reconciling biofuel production, food security and rural development. Much of what Brazil has done in the bioenergy area was accomplished by long-term policies and investment in research. In this context, BOEING, EMBRAER and FAPESP initiated this project to conduct a national assessment of the technological, economic and sustainability challenges and opportunities associated with the development and commercialization of sustainable biofuel for aviation in Brazil. UNICAMP was selected for the coordination of this study, with the charter to lead a highly qualified, multi-disciplinary research team.