Gasification Of Unconventional Feedstocks

#Gasification #Unconventional Feedstocks #Alternative Fuel #Waste to Energy #Biomass Gasification

Gasification of unconventional feedstocks represents a promising pathway for sustainable energy production. This process converts materials like biomass, waste plastics, and other non-traditional sources into syngas, a versatile fuel that can be used for electricity generation, chemical production, and transportation fuels. Utilizing unconventional feedstocks through gasification offers a viable solution for waste management, resource diversification, and reducing reliance on fossil fuels, contributing to a more circular economy and a cleaner energy future.

Gasification of Unconventional Feedstocks

World gasification capacity is expected to grow by more than 70% by 2015. While gasification is not a new process, the higher price in crude has lead operators and refineries to look at all possible coal-based technologies for energy conversion, and with the flow of heavy oil, tar sands and other unconventional feedstocks making their way to the refineries for processing, refinery managers and engineers alike must be made aware of how to process these uncommon energy sources. Gasification of Unconventional Feedstocks addresses these unfamiliar feeds and provides a quick and up-to-date reference on the background, process technology and downstream applications required to help refineries maximize profits turning low-value feedstock to beneficial syngas and other fuel products. Clear and comprehensive, Gasification of Unconventional Feedstocks provides engineers and refinery managers with the tools needed to quickly adapt to the more unconventional feedstocks and still maximize their refineries potential. Get up to speed on how to adjust your refinery's processing to unconventional feedstocks Understand the technology necessary to safely and effectively manage unfamiliar feeds Turn low-value product to profit quickly with must-have tips and rules of thumb

Gasification for Low-grade Feedstock

Most coveted energy forms nowadays are gas in nature and electricity due to their environmental cleanness and convenience. Recently, gasification market trend is starting to switch to low-grade feedstock such as biomass, wastes, and low-rank coal that are still not properly utilized. In this sense, the most promising area of development in gasification field lies in low-grade feedstock that should be converted to more user-friendly gas or electricity form in utilization. This book tried to shed light on the works on gasification from many parts of the world and thus can feel the technology status and the areas of interest regarding gasification for low-grade feedstock.

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Gasification for Practical Applications

Although there were many books and papers that deal with gasification, there has been only a few practical book explaining the technology in actual application and the market situation in reality. Gasification is a key technology in converting coal, biomass, and wastes to useful high-value products. Until renewable energy can provide affordable energy hopefully by the year 2030, gasification can bridge the transition period by providing the clean liquid fuels, gas, and chemicals from the low grade feedstock. Gasification still needs many upgrades and technology breakthroughs. It remains in the niche market, not fully competitive in the major market of electricity generation, chemicals, and liquid fuels that are supplied from relatively cheap fossil fuels. The book provides the practical information for researchers and graduate students who want to review the current situation, to upgrade, and to bring in a new idea to the conventional gasification technologies.

Handbook of Gasification Technology

Gasification is one of the most important advancements that has ever occurred in energy production. Using this technology, for example, coal can be gasified into a product that has roughly half the carbon footprint of coal. On a large scale, gasification could be considered a revolutionary development, not only prolonging the life of carbon-based fuels, but making them “greener” and cleaner. As long as much of the world still depends on fossil fuels, gasification will be an environmentally friendlier choice for energy production. But gasification is not just used for fossil fuels. Waste products that would normally be dumped into landfills or otherwise disposed of can be converted into energy through the process of gasification. The same is true of biofeedstocks and other types of feedstocks, thus making another argument for the widespread use of gasification. The Handbook of Gasification Technology covers all aspects of the gasification, in a “one-stop shop,” from the basic science of gasification and why it is needed to the energy sources, processes, chemicals, materials, and machinery used in the technology. Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook, this outstanding new volume is a must-have for any library.

Waste Energy for Life Cycle Assessment

This book provides technical data and information on unconventional- and inactive energy sources. After reviewing the current global energy situation, individual chapters discuss fossil fuel sources and renewable energy sources. It focuses on future energy systems and explores renewable energy scenarios including water energy and power, biofuels and algae energy. It also provides essential information on energy from inactive sources, energy from waste materials and the optimization of energy systems.

Gasification

Gasification provides an excellent overview of current technologies for the gasification of coal, oil, gas, biomass and waste feed stocks. Starting from the basic theory, it reviews the potential feed stocks and their suitability for different types of gasification process. Commercial and near-commercial processes are described individually and various features discussed in detail. There is a comprehensive review of contaminants in synthesis gas as well as of gas treating processes. Gasification, the key technology enabling the production of biofuels from all viable sources--some examples being sugar cane and switch grass. This versatile resource not only explains the basic principles of energy conversion systems, but also provides valuable insight into the design of biomass gasifiers. The author provides many worked out design problems, step-by-step design procedures and real data on commercially operating systems. After fossil fuels, biomass is the most widely used fuel in the world. Biomass

resources show a considerable potential in the long term if residues are properly handled and dedicated energy crops are grown.

Gasification

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Synthesis Gas

As a follow-up to the Handbook of Gasification Technology, also from Wiley-Scrivener, Synthesis Gas goes into more depth on how the products from this important technology can reduce our global carbon footprint and lead the United States, and other countries, toward energy independence. The environmental benefits are very high, and, along with carbon capture and renewable fuels, synthesis gas (or syngas) is a huge step toward environmental sustainability. Synthesis gas is one of the most important advancements that has ever occurred in energy production. Using this technology, for example, coal, biomass, waste products, or a combination of two or more of these can be gasified into a product that has roughly half the carbon footprint of coal alone. Used on a massive scale, just think of the potential for reducing carbon emissions! Synthesis Gas covers all aspects of the technology, from the chemistry, processes, and production, to the products, feedstocks, and even safety in the plant. Whether a veteran engineer or scientist using it as a reference or a professor using it as a textbook, this outstanding new volume is a must-have for any library.

Sustainable Treatment and Management of Sewage Sludge

This reference book provides updated information about the technological advancement in sustainable thermochemical bioprocessing of sewage sludge disposal and resource recovery. It discusses the innovative strategies of resource recovery for the formulation of feedstock, clean compost production and safe application. This book traces the main chemical and biological properties of sewage sludge and covers biostabilization, detoxification, the role of microorganisms in sewage sludge management and the sustainable use of sewage sludge from a circular economy perspective. Key Features • Discusses organic waste disposal and recycling • Covers knowledge transfer from waste bioprocessing to commercially important end products • Includes industrial application of biological and thermochemical sewage sludge treatment toward emerging nutrient recovery technologies • Reviews the function and applications of microorganisms in sewage sludge treatment • Describes the application of sewage sludge as fertilizers in agriculture This book is meant for researchers and industry experts in environmental sciences, biochemical engineering and biotechnology.

A Survey of Biomass Gasification

This book publishes some papers presented at The International Conference on Water Energy Food and Sustainability (ICoWEFS 2023), a major forum to foster innovation and exchange knowledge in the water-energy-food nexus. The topics covered embrace the Sustainable Development Goals (SDGs) of the United Nations, including Future trends in Water Security, Smart Technologies in Sustainable Energy Production Systems, Circular systems for rural and urban food and Integrated Ecosystems Management.

Proceedings of the 2nd International Conference on Water Energy Food and Sustainability (ICoWEFS 2022)

This book focuses on the various solvent processes that are used in crude oil refineries. It presents the differences between each type of process and discusses the types of feedstock that can be used

for the processes. This accessible guide is written for managers, professionals, and technicians as well as graduate students transitioning into the refining industry. . Key Features: • Describes the various steps that are necessary for the solvent treatment of various feedstocks in crude oil refineries. Brings the reader up to date and adds more data. Provides an extensive glossary. Considers next-generation processes and developments.

Solvent Processes in Refining Technology

Industrial and academic scientists face increasing challenges to find cost-effective and environmentally sound methods for converting natural resources into fuels, chemicals and energy. With over 7000 papers published in this field of catalysis each year, keeping up with the literature can be difficult. Catalysis Volume 27 presents critical and comprehensive reviews of the hottest literature published over the last twelve months. Covering major areas such as chemical transformations using two-dimensional hybrid nanocatalysts, conversion of biomass-derived syngas to fuels and catalytic oxidation of organic pollutants in aqueous solution using sulfate radicals, this book is a useful reference for anyone working in catalysis and an essential resource for any library.

Catalysis

Volume 2 covers the constituents of gas streams and their properties. The author presents the chemistry and engineering aspects of the methods and principles by which the gas streams might be cleaned from their noxious constituents. The concept of gas condensate is also discussed as well as the methods which can be applied to the analysis of streams and condensate. Vol. 1: Origin and Reservoir Engineering. Vol. 3: Uses of Gas and Effects.

Gas Engineering

This book reviews alternative and renewable energy resources in order to pave the way for a more sustainable production in the future. A multi-disciplinary team of authors provides a comprehensive overview of current technologies and future trends, including solar technologies, wind energy, hydropower, microbial electrochemical systems and various biomass sources for biofuel production. In addition, the book focuses on solutions for developing countries. Conventional energy sources are finite, and estimates suggest that they will be exhausted within a few decades. Finding a solution to this problem is a global challenge, and developing countries in particular are still highly dependent on fossil fuels due to their rapidly growing populations accompanied by a huge growth in primary energy consumption. Moreover, the most common conventional energy sources (coal and petroleum) are non-sustainable since their combustion exponentially increases greenhouse gas emissions. As such, there is a pressing need for clean energy based on alternative or renewable resources, not only to ensure energy supplies at an affordable price but also to protect the environment.

Alternative Energy Resources

A large expansion in ethanol production, along with research and innovation to develop second-generation biofuels, is underway in the U.S., spurred by volatile oil prices and energy policies. This increased focus on ethanol and other biofuels is an important element of U.S. economic, energy, environmental, and national security policies. This report will inform research recommendations to address the constraints surrounding availability of biomass feedstocks. To meet this goal, an economic assessment, which links to an analysis of the consequences for greenhouse gas emissions and sustainability, has been developed that encompasses feedstock production from agriculture and forestry sources. Illustrations.

Increasing Feedstock Production for Biofuels

Heavy Oil Recovery and Upgrading covers properties, factors, methods and all current and upcoming processes, giving engineers, new and experienced, the full spectrum of recovery choices, including SAGD, horizontal well technology, and hybrid approaches. Moving on to the upgrading and refining of the product, the book also includes information on in situ upgrading, refining options, and hydrogen production. Rounding out with environmental effects, management methods on refinery waste, and the possible future configurations within the refinery, this book provides engineers with a single source to make decisions and manage the full range of challenges. Presents the properties, mechanisms, screening criteria and field applications for heavy oil enhanced recovery projects Includes current

upgrading options and future methods for refining heavy oil development Fills in the gaps between literature and practical application for everyday industry reference

Heavy Oil Recovery and Upgrading

To reduce the dependence on dwindling crude oil reserves, the rational design of heterogeneous catalysts for the selective conversion of syngas into valuable fuels and chemicals is considered a principal scientific and industrial target. Syngas is an important intermediate for manufacturing clean fuels and chemicals, which can be derived from a variety of carbonaceous resources such as coal, natural gas, shale gas, municipal solid waste (MSW) or lignocellulosic biomass feedstocks through gasification or reforming technologies. The use of biomass feedstock and its derivatives (biomass-derived syngas) to produce renewable energy, carbon neutral and clean fuels and chemicals is gaining increasing interests because these resources can supplement existing supplies of raw materials and have less net environmental impact. This book provides recent research on the production, emerging technologies and ecological impacts of syngas.

The Influence of Feedstock Properties on Gasification Plant Performance

Since 1987, the Petroleum Division of the American Chemical Society (ACS) has sponsored at 3 year intervals an international symposium on fluid cracking catalysts (FCC) technology. This volume collects the recent progress of this technology as reported in the papers presented during the 232th National Meeting of the ACS in San Francisco, September 10-14, 2006. Sixty-six years after the introduction of the fluid cracking catalyst process, it remains the main process of gasoline generation for the estimated 237 millions cars on US roads. Catalysts testing and evaluation still remains a subject of interest, debate and controversy. Lambda sweep testing, testing of SOx, NOx and combustion promoters have been discussed in details together with catalyst evaluation for atmospheric residues and metal contaminated oils cracking. Of particular interest has been the introduction of novel concept in process design aimed at improving cracked product selectivity such as two-stage risers for better gasoline and olefins production and downer technology for high severity processes . The importance of solid state nuclear magnetic resonance (NMR) in the study of crude oils, catalysts and reaction products are illustrated by several examples. Two contributions describe the use of predictive methods to understand FCC aging and deactivation and personal overviews of the development of SOx and combustion promoters technology are presented. * Presents findings from the tri-annual international symposium on fluid cracking catalysts (FCC) technology, sponsored by the Petroleum Division of the American Chemical Society (ACS) * Two contributions describe the use of predictive methods to understand FCC aging and deactivation * Personal overviews by the authors of the development of SOx and combustion promoters technology

Oxygen and the Conversion of Future Feedstocks

Wastes: Solutions, Treatments and Opportunities II contains selected papers presented at the 4th edition of the International Conference Wastes: Solutions, Treatments and Opportunities, that took place 25-26 September 2017 at the Faculty of Engineering of the University of Porto, Porto, Portugal. The Wastes conference, which takes place biennially, is a prime forum for academics and industry representatives from the waste management and recycling sectors around the world to share their experience and knowledge with all in attendance. The published papers focus on a wide range of topics, including: Wastes as construction materials, Wastes as fuels, Waste treatment technologies,MSW management, Recycling of wastes and materials recovery, Wastes from new materials (nanomaterials, electronics, composites, etc.), Environmental, economic and social aspects in waste management and Circular economy.

Storage of Biomass Feedstocks: Risks and Opportunities

Membrane Technologies for Biorefining highlights the best practices needed for the efficient and environmentally-compatible separation techniques that are fundamental to the conversion of biomass to fuels and chemicals for use as alternatives to petroleum refining. Membrane technologies are increasingly of interest in biorefineries due to their modest energy consumption, low chemical requirements, and excellent separation efficiency. The book provides researchers in academia and industry with an authoritative overview of the different types of membranes and highlights the ways in which they can be applied in biorefineries for the production of chemicals and biofuels. Topics have been selected to highlight both the variety of raw materials treated in biorefineries and the range of biofuel

and chemical end-products. Presents the first book to focus specifically on membrane technologies in biorefineries Provides a comprehensive overview of the different types of membranes and highlight ways in which they can be applied in biorefineries for the production of chemicals and biofuels Topics selected highlight both the variety of raw materials treated using membranes in biorefineries and the range of biofuel and chemical end-products

Syngas

The petrochemical industry is a scientific and engineering field that encompasses the production of a wide range of chemicals and polymers. The purpose of this book is not only to provide a follow-on to form the later chapters of the highly successful Chemistry and Technology of Petroleum 5th Edition but also provides a simplified approach to a very diverse chemical subject dealing with the chemistry and technology of various petroleum and petrochemical process. Following from the introductory chapters, this book provides the readers with a valuable source of information containing insights into petrochemical reactions and products, process technology, and polymer synthesis. Provides readers with a valuable source of information containing insights into petrochemical reactions and products, process technology, and polymer synthesis Introduces the reader to the various petrochemical intermediates are generally produced by chemical conversion of primary petrochemicals to form more complicated derivative products The reactions and processes involved in transforming petroleum-based hydrocarbons into the chemicals that form the basis of the multi-billion dollar petrochemical industry are reviewed and described The book includes information on new process developments for the production of raw materials and intermediates for petrochemicals Includes a description of the origin of the raw materials for the petrochemicals industry – including an overview of the coal chemicals industry

Fluid Catalytic Cracking VII:

The Handbook of Clean Energy Systems brings together an international team of experts to present a comprehensive overview of the latest research, developments and practical applications throughout all areas of clean energy systems. Consolidating information which is currently scattered across a wide variety of literature sources, the handbook covers a broad range of topics in this interdisciplinary research field including both fossil and renewable energy systems. The development of intelligent energy systems for efficient energy processes and mitigation technologies for the reduction of environmental pollutants is explored in depth, and environmental, social and economic impacts are also addressed. Topics covered include: Volume 1 - Renewable Energy: Biomass resources and biofuel production; Bioenergy Utilization; Solar Energy; Wind Energy; Geothermal Energy; Tidal Energy. Volume 2 - Clean Energy Conversion Technologies: Steam/Vapor Power Generation; Gas Turbines Power Generation; Reciprocating Engines; Fuel Cells; Cogeneration and Polygeneration. Volume 3 - Mitigation Technologies: Carbon Capture; Negative Emissions System; Carbon Transportation; Carbon Storage; Emission Mitigation Technologies; Efficiency Improvements and Waste Management; Waste to Energy. Volume 4 - Intelligent Energy Systems: Future Electricity Markets; Diagnostic and Control of Energy Systems; New Electric Transmission Systems; Smart Grid and Modern Electrical Systems; Energy Efficiency of Municipal Energy Systems; Energy Efficiency of Industrial Energy Systems; Consumer Behaviors; Load Control and Management; Electric Car and Hybrid Car; Energy Efficiency Improvement. Volume 5 - Energy Storage: Thermal Energy Storage; Chemical Storage; Mechanical Storage; Electrochemical Storage; Integrated Storage Systems. Volume 6 - Sustainability of Energy Systems: Sustainability Indicators, Evaluation Criteria, and Reporting; Regulation and Policy; Finance and Investment; Emission Trading; Modeling and Analysis of Energy Systems; Energy vs. Development; Low Carbon Economy; Energy Efficiencies and Emission Reduction. Key features: Comprising over 3,500 pages in 6 volumes, HCES presents a comprehensive overview of the latest research, developments and practical applications throughout all areas of clean energy systems, consolidating a wealth of information which is currently scattered across a wide variety of literature sources. In addition to renewable energy systems, HCES also covers processes for the efficient and clean conversion of traditional fuels such as coal, oil and gas, energy storage systems, mitigation technologies for the reduction of environmental pollutants, and the development of intelligent energy systems. Environmental, social and economic impacts of energy systems are also addressed in depth. Published in full colour throughout. Fully indexed with cross referencing within and between all six volumes. Edited by leading researchers from academia and industry who are internationally renowned and active in their respective fields. Published in print and online. The online version is a single publication (i.e. no updates), available for one-time purchase or through annual subscription.

WASTES – Solutions, Treatments and Opportunities II

Methanol - The Chemical and Energy Feedstock of the Future offers a visionary yet unbiased view of methanol technology. Based on the groundbreaking 1986 publication "Methanol" by Friedrich Asinger, this book includes contributions by more than 40 experts from industry and academia. The authors and editors provide a comprehensive exposition of methanol chemistry and technology which is useful for a wide variety of scientists working in chemistry and energy related industries as well as academic researchers and even decision-makers and organisations concerned with the future of chemical and energy feedstocks.

Membrane Technologies for Biorefining

Policy-makers are sometimes faced with the challenge of making decisions based on the choice of biomass feedstocks to promote. As such, the book presents an examination of trade-off decisions that sometimes have to be made between the choices of feedstock needed to achieve the desired economic, social and ecological sustainability. In this book, readers find very resourceful information on the critical assessment and discussions on biomass as a feedstock across three major themes: production practices, technologies and environmental impacts. It gives useful insight into relatively unexplored pathways for biomass use in extant literature. The book will appeal to a broad range of energy professionals and specialists, researchers, students and others interested in the field of biomass feedstocks and sustainable energy. In ensuring that the environmental benefits of biomass derived fuel and energy are fully achieved, it is imperative that its environmental impacts are properly managed. Therefore, the book further provides readers with some unique methods of managing the environmental impacts of alternative biomass derived feedstocks.

Handbook of Petrochemical Processes

Aviation Fuels provides up-to-date data on fuel effects on combustion performance and use of alternative fuels in aircraft. This book covers the latest advances on aviation fuel technologies, including alternative fuels, feedstocks and manufacturing processes, combustion performance, chemical modeling, fuel systems compatibility and the technical and environmental challenges for implementing the use of alternative fuels for aviation. Aviation fuel and combustion researchers, academics, and program managers for aviation technologies will value this comprehensive overview and summary on the present status of aviation fuels. Presents an overview on all relevant fields of aviation fuels, including production, approval, fuel systems compatibility and combustion (including emissions) Discusses the environmental impacts and carbon footprint of alternative fuels Features a chapter on electric flight and hydrogen powered aircraft and how its implementation will impact the aviation industry

Pretreatment of Feedstock for Enhanced Biogas Production

Gasification is a technology that has been widely used in commercial applications for more than 50 years in the production of fuels and chemicals. Current trends in the chemical manufacturing and petroleum refinery industries indicate that use of gasification facilities to produce synthesis gas (“syngas”) will continue to increase. Attractive features of the technology include: 1) the ability to produce a consistent, high-quality syngas product that can be used for energy production or as a building block for other chemical manufacturing processes; and 2) the ability to accommodate a wide variety of gaseous, liquid, and solid feedstocks. Conventional fuels such as coal and oil, as well as low- or negative-value materials and wastes such as petroleum coke, heavy refinery residuals, secondary oil-bearing refinery materials, municipal sewage sludge, hydrocarbon contaminated soils, and chlorinated hydrocarbon byproducts have all been used successfully in gasification operations. Gasification of these materials has many potential benefits when compared with conventional options such combustion or disposal by incineration. Recently, the U.S. Environmental Protection Agency (EPA) announced that the Agency is considering an exclusion from the Resource Conservation and Recovery Act (RCRA) for listed secondary oil-bearing refinery materials when processed in a gasification system, an exclusion analogous to the one granted for insertion of RCRA listed refinery wastes into the coking process at refineries. In addition, representatives of the gasification industry have asked EPA to consider a broader exclusion that would include gasification of any carbonaceous material, including hazardous wastes from other industrial sectors (e.g., chemical manufacturing) in modern, high-temperature slagging gasifiers. The purpose of this report is to provide an independent, third-party description of waste gasification and to present information that clearly defines the differences between the modern gasification and incineration technologies. The primary focus of this document is the

currently proposed exemption for gasification of secondary oil-bearing materials in refineries. The objectives of this report are to: Compare and contrast the process unit operations and chemical reaction mechanisms of gasification and incineration; Cite environmental and regulatory concerns currently applicable to hazardous waste incineration processes and relate them to gasification processes; and Provide a summary of existing process stream characterization data for gasification including information on the data quality, sampling/analytical method applicability, and method development needs.

Handbook of Clean Energy Systems, 6 Volume Set

Record-high world oil prices have prompted renewed interest in producing liquid fuels from coal. The United States leads the world in recoverable coal reserves. Moreover, the technology for converting coal to liquid fuels already exists, and production costs appear competitive at world oil prices well below current levels. Yet, despite its promise, private investment in coal-to-liquids (CTL) technology is being impeded by three uncertainties: where oil prices are heading, what it actually costs to produce coal-derived fuels, and how greenhouse-gas emissions will be regulated. A domestic CTL industry could produce as much as three million barrels per day of transportation fuels by 2030. Having such an industry would yield important energy security benefits, most notably a lowering of world oil prices and a decrease in wealth transfers from oil users to oil producers. But establishing a large CTL industry also raises important policy and environmental issues associated with climate change, coal mining, and water consumption. Weighing both benefits and costs, it makes sense for the United States to pursue an insurance or hedge strategy that promotes the early construction and operation of a limited number of commercial CTL plants. This book presents an in-depth review of the prospects of and policy, governance, and environmental issues associated with establishing a CTL industry in the United States. -- provided by publisher.

Methanol: The Basic Chemical and Energy Feedstock of the Future

Biochemicals and Materials Production from Sustainable Biomass Resources provides a detailed overview of the experimentally developed approaches and strategies that facilitate carbon-based materials and fine chemicals derivation from biomass feedstocks with robust catalyst systems and renewed conversion routes. In addition, the book highlights theoretical methods like techno-economic analysis of biobutanol synthesis. As academia and industry are now striving to substitute fossil-based chemicals with alternative renewable resources, second-generation lignocellulosic biomass which does not depend on the food cycle has become increasingly important. Lignocellulosic biomass is composed of three major polymeric components - lignin, cellulose and hemicellulose. The polymers can be degraded into monomeric counterparts through selective conversion routes like hydrolysis of cellulose to glucose and of hemicellulose to xylose. Includes the recent development of biomass-derived high-value chemicals and functional materials Describes theoretical and technical details of specific conversion routes and preparation methods Covers jointly organic transformations, catalytic synthesis, reaction mechanisms, thermal stability, reaction parameters and solvent effects

Feedstocks

Petroleum refining involves refining crude petroleum as well as producing raw materials for the petrochemical industry. This book covers current refinery processes and process-types that are likely to come on-stream during the next three to five decades. The book includes (1) comparisons of conventional feedstocks with heavy oil, tar sand bitumen, and bio-feedstocks; (2) properties and refinability of the various feedstocks; (3) thermal processes versus hydroprocesses; and (4) the influence of refining on the environment.

Aviation Fuels

Technical report on biomass gasification potential in developing countries - provides an evaluation of energy policies, research and development and gasifier production in Brazil, the Philippines, Canada, USA, etc.; discusses the historical, current and potential applications in rural area electrification, irrigation, etc., as a substitute product to petroleum; obstacles and hazards; includes an economic analysis of installations (incl. Shaft-power and direct-heat systems). Bibliography, diagrams, graphs and photographs.

Substitute Natural Gas, Manufacture and Properties