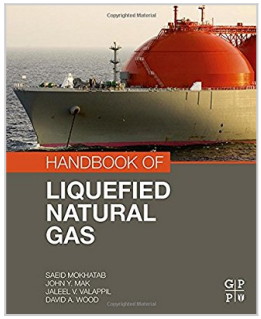

Handbook of Liquefied Natural Gas

By Saeid Mokhatab, John Y. Mak, Jaleel V. Valappil, David A. Wood

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Liquefied natural gas (LNG) is a commercially attractive phase of the commodity that facilitates the efficient handling and transportation of natural gas around the world. The LNG industry, using technologies proven over decades of development, continues to expand its markets, diversify its supply chains and increase its share of the global natural gas trade. The ***Handbook of Liquefied Natural Gas*** is a timely book as the industry is currently developing new large sources of supply and the technologies have evolved in recent years to enable offshore infrastructure to develop and handle resources in more remote and harsher environments. It is the only book of its kind, covering the many aspects of the LNG supply chain from liquefaction to regasification by addressing the LNG industries' fundamentals and markets, as well as detailed engineering and design principles. A unique, well-documented, and forward-thinking work, this reference book provides an ideal platform for scientists, engineers, and other professionals involved in the LNG industry to gain a better understanding of the key basic and advanced topics relevant to LNG projects in operation and/or in planning and development.

- Highlights the developments in the natural gas liquefaction industries and the challenges in meeting environmental regulations
- Provides guidelines in utilizing the full potential of LNG assets
- Offers advices on LNG plant design and operation based on proven practices and design experience
- Emphasizes technology selection and innovation with focus on a "fit-for-purpose" design
- Updates code and regulation, safety, and security requirements for LNG applications

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Editorial Review

Review

"This book is a great primer on all aspects of the LNG Industry. It contains the key information we all search for in a single location and it does an excellent job of highlighting the key considerations that must be taken into account for any LNG project in development." --**Tom Phalen, Vice President of Upstream Project Operations, Fluor, USA**

"As well as covering some topics rarely discussed and hard to find in the literature, the complex elements of the LNG industry are fully addressed in a straightforward fashion that makes the book appealing to all parties who are involved in the global LNG business." --**Philip Hunter, Senior LNG Consultant, Bechtel, UK**

"This is the first book which has filled all the gaps in the treatment of complete LNG supply chain from conceptual to commissioning and beyond. I will highly recommend it as a textbook for any Natural Gas graduate degree program anywhere." --**Dr. Suresh C. Sharma, Professor and Director of Natural Gas Engineering and Management, University of Oklahoma, USA**

"This comprehensive handbook provides practical guidance for all professionals in the LNG industry while maintaining as much rigor as possible. I believe academic institutions that have courses in natural gas engineering should consider this handbook as a textbook." --**Dr. Kenneth R. Hall, Professor of Chemical Engineering, Texas A&M University, USA**

"This book will be a welcome addition to libraries for anyone in the LNG Business from commercial, technical or operational. Even a brief review of the Table of Contents leaves one with a WOW and wondering where to start as it covers all the areas that one would want to either review or dive into something new. I highly recommend this valuable resource." --**David Messersmith, Bechtel Fellow and Manager of LNG Technology Group, Bechtel OG&C, USA**

"This well-balanced handbook is the only book of its kind, covering all aspects of the LNG supply chain in more detail. I highly recommend it as an excellent reference for all professionals, engineers, and scientists working in the LNG industry, and as a textbook for graduate students in the gas engineering curriculum." --**Dr. Brian F. Towler, Professor of Chemical and Petroleum Engineering and CEAS Fellow for Hydrocarbon Energy Resources, University of Wyoming, USA**

"This book is an important contribution to the professional literature in the crucial area of the emerging energy scene, offering a complete coverage of key topics in the LNG supply chain. The complete, accurate, and easy-to-use description of issues is also extended to cross-cut controversial topics such as LNG safety. The book provides an excellent access to a number of design guidelines and operating procedures, which makes it a standalone reference for LNG industry professionals and a state-of-theart textbook for graduate programs on the subject." --**Dr. Valerio Cozzani, Professor of Chemical Engineering and Director of Post-Graduate Program on Oil & Gas Process Design, University of Bologna, Italy**

"It is the first book on LNG supply chain management and gives an accurate picture of where the LNG industry stands today. This high-quality, comprehensive book provides a better understanding of LNG plant design and operational considerations and covers subject areas missed by other references in these areas. I believe it is a valuable addition to the literature and will serve as a desk reference for practicing engineers

and technologists, and as an excellent source of teaching and learning in undergraduate and graduate programs on the subject area." --**Dr. Faisal Khan, Professor and Vale Research Chair of Safety and Risk Engineering Memorial University, Canada**

"Given the fact that LNG is the fastest growing energy carrier in the world and the trend is toward a wider range of applications for LNG technologies, a handbook like this one covering the entire LNG supply chain with issues of design, operation, and safety will be highly appreciated by plant designers, engineers, and operators in the LNG industry. Of course, parts of the book also provide excellent textbook or reference material for graduate courses in the gas processing field." --**Dr. Truls Gundersen, Professor of Energy and Process Engineering Norwegian University of Science and Technology, Norway**

"The reference for liquefied natural gas (LNG) plant designers, engineers, and operators, and project developers and managers covers the complete LNG supply chain from liquefaction to regasification. It also summarizes the industry's fundamentals, engineering, and design principles, so can be used as a textbook for students in petroleum and chemical engineering curricula." --**ProtoView.com, 2014**

About the Author

Saeid Mokhatab is one of the most recognizable names in the natural gas community through his contributions to advancing the technologies in the natural gas processing industry. He has worked in a variety of senior technical and managerial positions with major petroleum companies and has been actively involved in several large-scale gas-field development projects, concentrating on design, precommissioning and startup of processing plants. He has presented numerous invited lectures on gas processing technologies, and has authored or co-authored over 200 technical publications including two well-known Elsevier's handbooks, which are considered by many as major references to be taken into account for any gas processing/LNG project in development. He founded the world's first peer-reviewed journal devoted to the natural gas science and engineering (published by Elsevier, USA); has held editorial positions in many scientific journals/book publishing companies for the hydrocarbon processing industry; and served as a member of technical committees for a number of professional societies and famous gas-processing conferences worldwide. As a result of his outstanding work in the natural gas industry, he has received a number of international awards/medals including the Einstein Gold Medal of Honor and Kapitsa Gold Medal of Honor; and his biography has been listed in highly prestigious directories.

John Y. Mak is a Senior Fellow and Technical Director at Fluor, USA, and leads the technology and design development for the chemical and energy sectors at Fluor. He has been with Fluor for over 40 years and has been leading domestic and global oil and gas and refinery projects from conceptual design, feasibility study, FEED and detailed engineering to plant startup and operation. John has made significant contributions to the technologies in natural gas treating, NGL recovery, LNG liquefaction and regasification, coal gasification and carbon capture. He is the co-author of the Handbook of Liquefied Natural Gas - 1st edition (2013) published by Elsevier, USA, and has presented over 60 technical papers at the GPA (Gas Processors Association) and LRGCC (Laurance Reid Gas Conditioning Conference), China Coal Forum and other technical conferences. John is the inventor of over 80 patent and patent-pending processes, which have been used in projects at Fluor. His patented technologies have been proven to improve energy efficiency, lower emissions, and reduce cost for many of his clients. John's current focus is on liquid recovery for shale gas projects and treating of the difficult gases, such as the high carbon dioxide and nitrogen content gases for offshore projects.

Jaleel V. Valappil is a senior engineering specialist with Bechtel Oil, Gas & Chemicals in Houston, TX, USA. He has several years of experience in process simulation, advanced process control and optimization of various processes including LNG. Before joining Bechtel, he was a senior consulting engineer with the

Advanced Control Services Group of Aspen Technology Inc., where he was responsible for developing and implementing advanced control and optimization solutions for a variety of processes. He has worked extensively on developing and deploying process simulation models for applications in design, engineering, and operations of LNG plant built by Bechtel in collaboration with Conoco Phillips over the years. He identified the benefits of lifecycle modeling for LNG plants and its use for plant design, operability/controllability studies, startup simulations and Operator Training Simulators, multi-train LNG facility debottlenecking and operational troubleshooting. Dr. Valappil has also developed and deployed Advanced Process Control technology for LNG processes, for plants in engineering stage and plants that are already operating. He has published several papers on LNG plant simulation and control in both industry conferences and journals and holds patents related to LNG plant control and turbo-machinery operation.

David A. Wood has more than thirty years of international oil and gas experience spanning technical and commercial exploration and production operations, midstream and downstream projects, contract evaluation and senior corporate management. His early energy industry experience includes Phillips Petroleum, Amoco, Lundin Oil and other independents working around the world. For the past two decades, David has worked as an independent international consultant, researhcer, training provider and expert witness, based in the UK and working on projects across the world. He has published an extensive body of work of over 250 publications on diverse energy related topics including: the international energy markets, oil and gas fiscal designs, LNG, GTL, gas storage and gas supply. His current research interests include multi-objective optimization and applied to drilling, production and project planning. He frequently acts as an advisor and/or trainer to governments and companies on many technical and commercial aspects of the oil and gas industry through his consultancy, DWA Energy Limited. This includes providing training on enhanced oil and gas recovery (EOR/EGR) to technical organizations and financial institutions. He also has extensive editorial experience as a founding Editor of Elsevier's Journal of Natural Gas Science and Engineering from 2008-2009 and serving as Editor-in-Chief for that journal from 2013-2016. David obtained his PhD from Imperial College, London (UK) in 1977 and worked as a post-doctoral research fellow in the Institute de Physique du Globe (Paris, France) and Birmingham Univeristy (UK).

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Annie Boyd:

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