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BOOK REVIEWS

Monetizing Natural Gas in the New “New Deal” Economy, edited by Michelle Michot Foss, Anna Mikulska, and Gürcan Gülen (Palgrave Macmillan, 2021). 492 Pages, ISBN 978-3-030-59982-9 Hardback, ISBN 978-3-030-59983-6 (eBook).

Introduction

Although natural gas resources across the globe are large, producing and transforming this gas into cold cash is fraught with challenges. Such “monetization” of natural gas resources requires planning, forethought, and a great deal of upfront cost. Unlike oil which can be moved by a wide variety of relatively low-cost methods, natural gas requires extensive capital investments in storage, pipelines and in some cases liquefaction. The process of commercializing gas resources has been made more difficult by policies aimed at achieving “net zero” greenhouse gas emissions in a shortened timeframe. No one wants to build an infrastructure that will be dismantled or abandoned before its useful life is over and this has become a conundrum for policy makers. Substituting gas for coal in the next decade can reduce greenhouse gas emissions, but shorter than normal pipeline and infrastructure lifespans raise capital costs and inhibit development. This book provides an historical overview of the natural gas market in the context of these dramatic challenges: huge up-front capital costs for long-lived investments, complications in developing integrated natural gas and power systems, and the changing petrochemical landscape.

The theme of the book is revealed by its title. A decade ago, the “new deal” for natural gas was thought to be a bridge to the future, because it burns cleaner and emits less carbon dioxide than other hydrocarbons. Gas is particularly beneficial in power generation when it replaces coal. However, there is increasing pressure from those concerned about climate change to skip over all hydrocarbons and go directly to solar, wind, and other non-emitting energy sources. This has been underscored by a continuing drop in renewable energy costs. Thus, natural gas advocates face a challenging landscape or even newer “new deal,” when seeking new regulatory approval for pipelines and other infrastructure investments, particularly if integrating hydrogen or other clean fuels into the pipeline network proves too costly. In a nutshell, policy makers and regulators fear that once built, methane will continue to be used long past its prescribed lifetime, inhibiting the development of renewable alternatives. This has made siting gas infrastructure particularly difficult.

Chapter contents

The book is organized as a series of chapters written by different authors. The forward by Jonathan Stern (“The Future of Gas—What Are the Key Issues?”) summarizes global gas demand and supply, provides historical perspective as well as surveying some selective projections and future scenarios by interested stakeholders (e.g. International Energy Agency, some integrated oil companies, and environmental groups). Stern’s analysis includes regional and country analysis of liquified natural gas (LNG) development and pricing. It is striking that there is considerable wholesale price diversity across time and regions. Stern points out that natural gas may no longer be viewed as a transition bridge to a carbon-free world. He notes that sorting out this tension depends on government policies required to meet changing greenhouse gas reduction commitments.

In Chapter 1 (“All Value Chains Begin Upstream”), Michelle Michot Foss begins with a central thought: the discovery or extension of a natural gas resource base provokes investment in transmission and distribution pipelines. This is somewhat obvious, because if you don’t have a gas source there is no point in building a delivery infrastructure. Nonetheless, for the industry it means that capital investment begins up front and ultimately flows downstream to distributed consumers. Foss describes in some detail the development of the U.S. gas market and notes that it is remarkable

in that almost all resources and infrastructure are privately owned and financed. This structure allowed the development of shale gas which now represents the largest share of gas production in the U.S. Chapter 1 contains a huge amount of information on the nature of U.S. gas production, particularly shale gas. In this respect the chapter is an invaluable source of historical knowledge even for seasoned veterans of the energy industry.

In Chapter 2 (“The Gas-Power Nexus”), Gürcan Gülen deals with the important connection between gas-fired power generation and the natural gas market. Gülen points out that overall electricity demand did not appreciably grow from 2008 to 2021. Thus, the gas market cannot count on new gas-fired generation to expand gas consumption. Moreover, wind and solar generation have increased more rapidly than expected. Gülen notes that the promotion of environmental, social, and governance (ESG) standards by the financial community has had an inhibiting impact on natural gas infrastructure investments. Nonetheless, the power sector is bound to increase its use of natural gas, partly because it is a complement to intermittent renewable power and, also because there will be rising demand for new efficient base load facilities that burn natural gas.

In Chapter 3 (“Petrochemicals: An Industrial Renaissance?”), Michelle Michot Foss, Gürcan Gülen, Danny Quijano, and Barbara Shook discuss the likely development of the U.S. petrochemical industry. The petrochemical industry endured a downturn in the early 2000s due to rising natural gas prices. Much of the industry was shut down or moved to regions with a cheaper feedstock. The shale revolution reversed the decline due to lower prices and the significant volume increase in natural gas production, including natural gas liquids (NGLs). As the chapter’s title implies, the shale revolution has driven a renaissance in the U.S. petrochemical industry. It is worth noting that Russia’s Ukrainian war further tightened the market for petrochemicals, greatly benefitting the industry. The authors suggest that there might be a second wave of U.S. petrochemical development after 2025, but they did not, of course, foresee the impact of the Ukrainian war, which has undoubtedly accelerated that development.

In Chapter 4 (“LNG in the Global Context”), Andy Flower covers the U.S. LNG market. Not so long ago, it was expected that the U.S. would overtake Japan as the world’s largest gas importer. Proposals were made to build up to fifty LNG receiving terminals and eight were built. By 2010, however, the shale revolution reversed the perceived market. Cheniere Energy was the first to convert an import terminal into an LNG export plant and others followed. Significantly, the pricing model was based on U.S. price indexes rather than an oil-based pricing (previously common in most LNG contracts). The shift in pricing provided far greater delivery flexibility. Flower did not foresee the war and so missed the massive increase in demand for LNG exports that followed and the speed at which the industry responded. Nonetheless, he provides a comprehensive analysis of LNG economics and a good review of the history of U.S. LNG imports and exports.

Chapter 5 (“Between the Old and New Worlds of Natural Gas Demand”) by Anna Mikulska and Gürcan Gülen describes the shift from regional to global gas markets. Traditionally, resource development required a large regulated or state-owned buyer to contract with a large supplier. In many cases the absence of such entities prevented the monetization of gas resources. Another consequence was rigidities in contract and regulated terms which have only recently been loosened. The authors note that electricity and gas market liberalization across the world since the 1980s often favored the development of natural gas resources. Nonetheless, many gas discoveries were not developed because monetization was difficult. The authors draw a distinction between the “old” world, where gas infrastructures already existed and the “new” world where they are being developed. Much of the chapter surveys current and prospective development in both the new and old world.

In Chapter 6 (“Building Sustainable Natural Gas Markets”), Michelle Michot Foss and Gürcan Gülen discuss challenges building natural gas infrastructure going forward. Traditionally, gas development requires an anchor project or existing infrastructure to kick start the project. In the early days, the anchor was the existing coal gas infrastructure. This was also a recent case when South Africa’s Sasol converted its existing coal gas system to natural gas sourced in Mozambique.

More recently, large scale gas-fired power generation or LNG projects have fulfilled this role with other markets sometimes filling in later.

The authors provide a decision tree for monetizing natural gas. Notably, the tree identifies a multitude of roadblocks that keep projects from getting off the ground. They include limited infrastructure, absence of predictable legal and commercial framework, and resistance from competing local stakeholders. In many cases a limited number of players constrain a market-based approach. The North American natural gas market is noteworthy for its liquidity – that is, a multitude of buyers and sellers interacting in ways that reduce the transactions cost of trading and allow for efficient price determination. Many of the world’s regional gas markets do not yet have this advantage and they will likely evolve more slowly than others.

Chapter 7 (“Conclusion and Path Forward”) by Foss, Mikuska and Gülen sums up the book’s themes and challenges. Because the likely future composition of buyers and producers is far more diverse and geographically spread out, the monetization of new gas supplies is likely to be more complex and uncertain than it has been in the past. They note geographical misalignments of supply and demand create opportunities for natural gas monetization. At the same time, the misalignments stimulate complexity because the demand for gas is often far afield from supply. This, of course, describes development in new world economies, which is where most of the action will likely take place.

Impressions and comment

The book was finished in mid-2021, before Russia’s manipulation of the European gas market and before its invasion of Ukraine. In some respects, this is unfortunate, because the war changed global gas markets dramatically. Most importantly, energy security once again became a dominant feature of energy policy while it is given less attention in this book. Events in the last year underscored the fragility of pipelines especially when pipelines run across international borders. Both the Nord Stream 1 and 2 pipelines were blown up and put out of use for months if not years. Significantly, this revealed that destruction costs are well below construction costs. The asymmetrical relationship poses a new type of threat, seldom accounted for in traditional U.S. energy security analysis, which relies on enhanced domestic production and energy conservation to reduce foreign energy imports. There are, however, alternatives to the U.S. approach to energy security. Due to limited domestic energy resources, Japan, for example, focused on supply diversification for both oil and natural gas. This suggests that much future gas development will rely on the LNG market, which may have a far more flexible delivery infrastructure and need not be tied to a single buyer or location.

Overall, this book is not an introduction to the natural gas industry, it is a deep dive into a multitude of challenges to constructing the necessary infrastructure necessary to support gas development. The problems faced by “old” world economies may be different from that of “new” world economies, but there is an underlying message for both. Natural gas may provide significant short-term benefits for reducing greenhouse gases, but in the longer term its continued use is unlikely to allow nations to get to “net-zero” carbon emissions. This dilemma is holding back the monetization of natural gas reserves and the immediate benefits of cheaper and cleaner energy sources. As the authors put it: “At the core of the conundrum in which the natural gas industry finds itself is whether natural gas use in key applications such as electric power should or can be discouraged and, if so, in which geographies.”

Because the book is a compilation of various authors, the result is somewhat unwieldy, and it occasionally strays from its central theme. Some aspects of the book have been overturned by the Ukraine war; nonetheless, the central point is enduring and, consequently, it makes a valuable contribution to our understanding of the natural gas market and the dilemma that regulators and policy officials must sort out if an energy transition is to be achieved at reasonable cost.

Audience for the book

Most of the issues covered in the book are familiar to executives of the natural gas industry but could be of great benefit to policy makers, regulators, intervenors, and students who wish to understand the multitude of issues concerning proposed expansions of gas delivery infrastructures. In most cases there are tradeoffs between cost, greenhouse gas emissions, reliability, and energy security. This book helps to identify such tradeoffs as well as describe the role of natural gas as a facilitator of many renewable energy options.

Sam Van Vactor
Economic Insight

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The Economics of Oil and Gas, by Xiaoyi Mu (Agenda Publishing, 2020). 275 pages, ISBN: 978-1-911116-28-8 (paperback).

The oil and gas industry significantly impacts individuals as well as the broader global economy and the environment. However, many people are unaware of the magnitude and intricacies of these impacts. Understanding the industry is challenging due to its 100+-year history, global reach, and complex connections with public policy and economic development. This book provides a better understanding with a comprehensive overview of the oil and gas industry and its impact on the global economy. It covers the industry's entire supply chain, from exploration to marketing, and includes relevant technological and theoretical information for each stage. Mu emphasizes the significance of the oil industry as a driving force behind economic growth and addresses the challenges such as risk, geopolitical ties, environmental concerns, and infrastructure dependency that impact its practice and policy.

The author, Xiaoyi Mu, is an energy economist and professor at the University of Dundee's Centre for Energy, Petroleum, and Mineral Law and Policy. He has been teaching at the institution since 2008 and has noted a steady interest in oil and gas economics among his students. However, he observed a lack of a comprehensive and up-to-date text on the oil and gas industry. After being approached by a publisher, Mu agreed to write this book drawing from his courses and expertise.

The book is intended to provide law, business, and economics students, as well as professionals interested in the industry, with a clear and detailed account of the oil and gas industry value chain, connecting practical information, policy discussions, and economic theory. The author examines various topics in this book using information compiled from various sources, offering a bird's-eye view of the economics of the industry rather than presenting original research or attempting to change the economics of oil and gas.

The wealth of information in this book, especially the detailed connections between the components of the oil and gas industry, makes it a valuable and unique addition to the field. The complicated nature of this industry makes Mu's perspective especially valuable, as most sources are unlikely to contain the information necessary to contextualize specific topics within the industry as a whole.

Mu covers each stage of the oil and gas value chain, including exploration, development, production, agreements and contracts, transportation, refining, marketing, and natural gas monetization. He discusses these topics from the perspective of economic theory, public policy, industry practices, and technical information. This allows the reader to gain a complete understanding of the industry and answer big questions, such as "Why is the oil price so volatile?" and "Why is there a disparity between changes in crude oil price and gasoline prices at the pump?"

Mu's methodology in relating this information to readers is very effective for the topic. By nature, any general account of the parts of the oil and gas industry must contain vastly different types

of information while clearly explaining their connections. Mu effectively establishes a reader's understanding by following a clear order of topics and building upon information he has previously covered. He begins the book with an introduction to oil, discussing the characteristics that make it a vital global resource and affect its markets. Oil's connection to macroeconomic growth is explored, which includes a discussion on the factors that affect the economies of oil-exporting and importing nations. The second chapter begins with the actual account of the oil supply chain, beginning with development and production. This chapter illustrates the interaction between Mu's various perspectives. He covers the practical aspects of exploration, development, and production of petroleum. This information is highly specific and technical, but it is necessary to understand because of its impact on economic factors. Mu builds on this technical information to outline the economic concepts at play and the analytical tools used by the industry's businesses. This chapter also includes information on risk modeling, development issues, and production strategies. Mu connects these topics throughout the book using models, mathematical examples, and detailed graphics to keep concepts clear and consistent.

Chapter 3 explores oil contracts and upstream production, discussing legal and political factors alongside economic analysis and financial models used in this part of the industry. Mu covers transport in chapter 4, which heavily relies on crucial technical information. For example, a practical understanding of oil tankers and their role in the industry is necessary to fully grasp the modeling of economies of scale and logistical challenges in oil transportation. Because of the political nature of pipelines, this topic is discussed in connection with public policy as well as in terms of market forces. Chapter 5 examines the refining and marketing phase of the oil supply chain, again connecting its technical aspects to their relationship to global economic trends and pricing issues. In chapter 6, Mu switches focus to cover the monetization of natural gas. This chapter includes the important physical characteristics of natural gas as well as the technology and pricing structures of this part of the industry. Finally, chapter 7 provides a discussion of oil prices, outlining their history and effects on policy. Economic theory relating to price determination and dynamics in the physical markets is presented along with some discussion of futures market. His approach provides the reader with a clearly structured account of the industry that logically orders the range of topics covered.

The oil and gas industry has a complex relationship with numerous variables, and the evidence used in Mu's book reflects this. This book does not just contain a lot of information; it contains a lot of information from several fields and perspectives. He draws from many sources of information depending on the area he focuses on, connecting them as appropriate. Overall, the book contains data and information on history, industry technology, economic theory, practical logistics, global politics, and firm decision-making. Without the author's thoughtful and intentional approach, this information could easily have been presented in a way that readers find confusing or overwhelming. Instead, Mu's approach allows the reader to gain a perspective of the industry that is generally applicable and consistent with economic theory, while being based on a detailed practical understanding. The content and form of the book are well suited to the author's goal of balancing detail with general coverage, and the book is very appropriate for its intended audience of students and professionals. It can be used as a classroom text for students in relevant disciplines, while at the same time, it is a beneficial resource for anyone that would like a more detailed understanding of the oil and gas industry. This book represents a significant achievement by the author for its ability to clearly and directly communicate information on one of the world's most influential and vital industries.

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