RISKS, REWARDS AND REGULATION OF UNCONVENTIONAL GAS

A Global Perspective

The global energy transition from carbon-intensive to renewable fuels has increasingly demanded a better understanding of the causes and consequences of the rapid development of unconventional oil and gas. Focusing on key countries including the US, Canada, China, Argentina, the UK and Australia, this book consists of case studies and in-depth analyses that weigh up the risks and rewards at regional, national and global scales. Explaining how and why unconventional fuels are transforming the global energy landscape, the strengths, weaknesses, opportunities and threats are explored through a political, economic and governance-based perspective. Emphasis is placed on how to regulate the industry; the discussion encompasses local issues, stakeholder engagement and the social licence to operate. The new baseline studies and standards introduced in this book provide a timely insight into the trade-offs across the social, economic and environmental domains, making it an ideal text for researchers and policymakers in energy fields and for graduate students.

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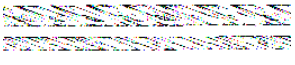

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Foreword

The unconventional oil and gas industry has already transformed global energy markets and, with the arrival of unconventional gas and oil exports from the United States and Australia, this change seems likely to become more pervasive and powerful.

The International Energy Agency (IEA) first discussed this revolution in unconventional hydrocarbon production some years ago. Worldwide resources of unconventional hydrocarbons are vast, albeit still poorly understood in most countries. Whether they are developed at scale, particularly beyond North America and Australia, will depend on a number of factors, including the deployment of technology in a safe, sustainable, way that addresses concerns over social and environmental issues but also draws on the experiences of regulators in those regions where development has been most advanced. Recognising the importance of a strong regulatory presence, the IEA has convened a number of global forums to share that experience and best practice among national and provincial level regulators.

Risks, Rewards and Regulation of Unconventional Gas: A Global Perspective explains clearly that regulatory responses to the social and environmental concerns stemming from unconventional gas development have varied widely among countries and provinces. These responses reflect the vastly varying cultural, societal and economic contexts and range from outright prohibitions to cautious, evolving, policy approaches as the industry makes wide-ranging operational improvements. Public concerns have helped regulators to focus on issues such as water management, potential induced seismicity, control of fugitive methane emissions and greater transparency on the use and type of chemicals in hydraulic fracturing.

This book, which includes contributions by experts in their field, sets out the evolution of regulation in a number of jurisdictions with the most practical experience in unconventional hydrocarbon production in the United States, Canada and Australia. The editors do not shy away from the fact that even in those countries a wide range of approaches has been taken; these include moratoria or reversals of approvals. The book summarises the potential to develop new industries in many other resource-rich countries without underestimating the practical difficulties of translating experience from a few countries to a global scale.

In sum, the editors are to be commended for putting together a balanced and fact-based overview of the last decade of global unconventional gas development. Overall, this book provides a complete perspective of the risks and opportunities of unconventional gas and clearly demonstrates that the social licence for industry to exploit gas must be gained and

retained, through regulation that is properly resourced and focused on key issues. The book will allow readers to understand the drivers and implications of unconventional gas at regional, national and global level.

If the unconventional gas industry is to deliver the benefits already seen in North America on a global scale then effective, transparent, regulation will be needed in all jurisdictions. There is much to be learnt from the successes and failures to date, and this volume is an important contribution that draws together the lessons learned and how to apply them in a way appropriate to each country's circumstances.

Dr Fatih Birol
Executive Director
International Energy Agency

Preface

R. QUENTIN GRAFTON, IAN CRONSHAW AND MICHAL MOORE

Energy requirements, especially those concerned with electric power, are by definition underpinned by technology and fuel choices. System operators will always seek out the most effective combination of service capacity and cost and, more recently, fuels with optimal policy support. Preferences have gradually shifted over time to natural gas technology, substituting for coal, replacing some nuclear capacity and even displacing certain hydroelectric facilities. This in turn has strained the sources of conventional natural gas and initiated a rush to develop unconventional natural gas supplies efficiently.

The last decade has seen the deployment of a number of innovative technologies and techniques to free up the gas long known to be contained in several North American hydrocarbon producing areas, firstly in Texas but then in Canada's western sedimentary basin and most recently in the Marcellus formation, located mostly in western Pennsylvania. Shale gas now accounts for more than half the US gas output, a large rise from only a few per cent in 2005. Oil output in the same period has almost doubled to levels last seen at the beginning of the 1970s, again using the same innovative techniques, rapidly deployed and improved.

Unconventional oil and gas production has transformed the global gas and oil trade. Patterns have been completely changed, so that liquefied natural gas (LNG) originally intended for the US has been sold into other markets, improving European gas security and making a major contribution to meeting Japan's power shortfall after the Fukushima disaster. In February 2016 the US began exporting LNG; a few years may see the United States rivalling Australia or Qatar as the largest global LNG exporter. And, contrary to pundit expectations, US oil imports have fallen substantially, which in turn has shifted the geographical balance of oil trade from the Atlantic Basin to Asia and the Pacific.

The rapid developments from unconventional oil and gas production have brought large benefits at national, regional and local levels, in terms of cheaper energy, jobs, and government revenues as well as enhanced energy security and reduced carbon emissions. The rapid expansion of the industry, and the huge drilling programmes associated with that expansion, have also had negative consequences in terms of environmental damage, contaminated groundwater and a negative social impact on some communities. The speed of unconventional oil and gas expansion has also strained the capacity and capability

of regulators. Some of these effects in rural Pennsylvania were documented in the 2010 film *Gasland*, which generated global concerns about unconventional gas production and hydraulic fracturing.

The cumulative impacts of unconventional oil and gas are now recognised through regional or basin-wide approaches, such as those seen in parts of the United States, Canada and Australia. Consequently, over time, governments, regulators and industry have begun to respond to these issues, with better-resourced regulatory bodies, often purpose built, and more comprehensive frameworks to manage or mitigate potential water contamination, air pollution, seismic impacts and noise and drilling disruptions.

Industry has responded to community concerns, and falling prices, by remarkable improvements in productivity and improved environmental performance. Such improvements, including the greater use of pad drilling and water recycling, have driven down costs while reducing water and use of chemicals. While regulation has generally been at the state or provincial level, federal governments in all three countries have played important roles, led by the US Environmental Protection Agency (EPA). Cooperative approaches involving industry, governments and research bodies have also played an important role in improving productivity, reducing environmental impacts and managing social outcomes better. Outright prohibitions, for example on the use of certain chemicals, and proscriptive approaches to ensure well integrity, have been employed alongside more incentive-based approaches to improve standards.

Despite this progress, support for the industry, and especially its principal tool, hydraulic fracturing, is controversial. In a number of jurisdictions, some even adjacent to producing areas, the industry's hydraulic fracturing techniques are banned outright; these jurisdictions include certain states in the United States and Australia and Canadian provinces, although in these countries as a whole unconventional gas is well established. Outright bans can also be found in some countries, such as France. There is also very strong local opposition to unconventional gas production in places such as the United Kingdom, where rural population densities are high and incentives for local landowners to allow drilling are weak. Without doubt, the unconventional gas and oil industry is struggling to win widespread acceptance; its ongoing success will be critically dependent on continuous improvement in its environmental and perceived social impacts. In sum, the unconventional gas industry must gain and retain its social licence to operate.

While resources of shale gas, coal bed methane, tight gas and other types of unconventional gas are globally widespread, the industry has been slow to achieve the same success as that seen in North America. This is due to differing geological conditions, the lack of skilled and experienced human and capital resources of established markets or the result of unpredictable above-ground conditions such as taxation, foreign investment and intellectual property issues. Despite early predictions that the unconventional oil and gas industry would rapidly spread, progress in places as diverse as Argentina, China and South Africa has been slow.

A common factor shared by all regions is concern about environmental and social issues, often compounded by water management issues, to do with its use, extraction or disposal,

coupled with fears of the possible contamination of drinking or agricultural water sources. These issues exist even where oil and gas have been extracted for some time but are more pronounced where there is little experience with hydrocarbon extraction or where the population density is high.

Many independent professional scientific reviews have concluded that the industry is safe, but only if it is properly managed and effectively regulated. There is concern that the industry is still relatively opaque; transparency can and must be improved, including on location and the use of enhanced well-stimulation techniques including hydraulic fracturing. Water use needs to be minimised, recycling encouraged and the disposal and beneficial use of waste streams improved. Methane emissions from gas and oil production could negate the environmental benefits of gas use, including in the power sector, industry and homes, but effective control technologies are available with the potential to largely overcome this problem.

Our book sets out to examine how unconventional gas production has grown over the last decade and how regulations have evolved to balance the demands of a new and valuable industry with pressing social and environmental issues. Developments in key producing areas are given more detailed treatment, as these regions have the most experience in dealing with these issues. The contrasts and similarities in different regulatory approaches, including outright bans, are analysed. Prospective countries and regions or where development is just beginning are also considered, and the reasons why production may be slower to develop in those places are highlighted.

We, the editors, believe that the industry can make a positive contribution at many levels, but the asymmetry between the benefits accruing at regional or national level and the many negative impacts which are borne at local level needs to be recognised and responded to in an effective manner.

The future growth of the gas industry remains uncertain. Energy demand growth is increasingly to be found in developing Asia, where gas supplies, either as local, potentially unconventional, gas production or as pipeline or LNG imports, will be expensive even at low oil prices. Hence, conventional and unconventional natural gas may struggle to compete against very low priced coal and increasingly competitive renewables, even when the versatility, flexibility and low environmental footprint of gas are taken into account; this will be especially true in the key power sector, where competition is strongest. In developed economies in Europe, gas demand is faltering, as economic growth remains weak, industrial structural change continues and new energy technologies, especially renewable power, make major inroads.

A growing consensus that urgent climate change issues must be effectively and speedily addressed will affect fossil fuel use, although it seems likely that the growing decarbonisation of the power sector – a key route to lower carbon emissions – will have a bigger impact on coal than on oil and gas supply and demand. Into this uncertain market outlook, the growth of unconventional gas and oil output outside North America is influenced by major geological differences and widely divergent institutional, industry-capability and other factors such as higher population densities and water availability.

On one point we are convinced: effective, efficient and ongoing regulation associated with unconventional gas and oil and a 'social licence' will be a prerequisite for the global success of the industry and for unlocking its benefits to landholders and communities, in addition to gas companies and governments. This book highlights these developments and the growing breadth, depth and effectiveness of regulators, so that all jurisdictions can learn, build on and profit from the lessons of others.

RQG, IGC and MCM

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