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INVESTING IN

ENERGY

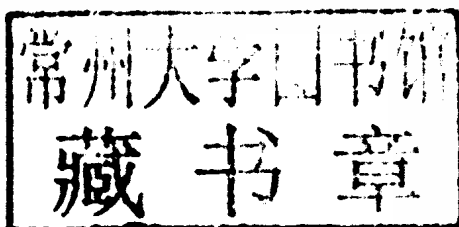
A PRIMER ON THE ECONOMICS
OF THE ENERGY INDUSTRY

GIANNA BERN

INVESTING IN ENERGY

A Primer on the Economics of
the Energy Industry

Gianna Bern



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Preface

It is my sincere hope that this book lays a foundation for those new to energy and fills in gaps for the veterans of the energy sector. The energy sector is a very complex and growing sector for investment. *Investing in Energy* illustrates numerous developments worthy of consideration and review by those interested in learning more about and investing in energy.

This book takes a comprehensive and financial approach to learning about oil, gas, and renewable energy. Part I reviews financial considerations necessary for evaluating and assessing cash flow, capital structure, and the role of capital markets across a myriad of energy sector firms.

Part II is the heart of the book and covers the economics inherent to the oil and gas sector such as reserves, production, crack spreads, and refining economics. We also review certain basics relevant to the oil and gas markets and explore why the crude oil and natural gas markets behave the way they do. Part II considers the role of OPEC, production rights, oilfield sector companies, oil juniors, independent oil companies, and national oil companies. Finally, Part II evaluates the complex landscape of crude oil pricing and its volatility in the commodity markets.

Part III of *Investing in Energy* assesses the current state of the power sector across various global markets. In this section, we bring readers up to date on developments in solar energy, hydro electrical power, nuclear power, geothermal electricity, and wind energy.

Part IV addresses developments in green energy such as bio fuels and ethanol. Once again, we analyze various other global markets, to ascertain where there are challenges and perhaps some opportunities across the energy landscape for biofuels, biomass, and ethanol.

Part V concludes with a summary of various opportunities we explored in the book and reviews the notion of energy policy as a sovereign's strategic and economic imperative.

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Books are rarely the efforts of a single individual. I must acknowledge the incredible assistance from my husband and business partner Lester Bern, whose insights, advice, and editorial assistance are pervasive throughout this book. He kept my feet to the fire, always insisting upon perfection; this book would not have been possible without his help. I would also like to acknowledge my appreciation for Lester's technical and editorial expertise in chapters 16–19.

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PART I

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CHAPTER 1

Historical Perspectives

The energy industry is undergoing unprecedented change as it reacts to new challenges in safety, regulation, exploration, and alternative-energy initiatives. One need only layer on the global political environment and the long-ranging repercussions of the 2010 Gulf of Mexico oil spill or the turmoil in the Middle East to realize that the energy sector is as complex as it has ever been. From this increasing complexity springs the need for this book. The following pages present a framework for understanding the basic elements of energy-industry economics. While not covering geology or refining from technical standpoints, this book provides a framework for analyzing the industry's basics and economics, and thereby helps prepare investors and other energy-industry professionals to more confidently venture forth into this vast and complex sector.

This book explores various opportunities available to investors in the energy arena and provides tools to better equip those new and not so new to investing in oil, gas, and alternatively generated energy. Time-tested analytic tools and investment criteria are utilized to provide the reader a better understanding of the economics behind the various energy sectors. Thoughtful and deliberate use of these analytic tools should enable deeper understandings of opportunities and more confident investment decisions. Also, long after the scent of fresh ink and paper have faded, we hope that this book will remain a trusted reference on many facets of commercial energy markets.

Chapter 1 explores some of the issues of the day in energy and places it in a historical context. We also review some of the key issues such as production and reserve growth for oil and gas producers. Cost structures continue to be a key consideration for alternative energy producers as project sponsors grapple with reducing electricity costs to become more competitive with that of fossil fuel producers. Next, we layer in the challenges in the regulatory environment that affect all energy producers. This chapter sets the foundation on which the next 21 chapters will build.

Oil and Gas Producers

A term that is used often in this book is *integrated major* (or major). This term refers to the industry business model of a large, vertically integrated oil and gas producer that has upstream, midstream, and downstream operations. Upstream refers to exploration and production, midstream consists of storage and transport, downstream refers to refining and retail operations. For integrated majors, the road ahead is one marked with significant challenges. In the wake of maturing basins, integrated majors are faced with stable to decreasing crude oil and natural gas production. The majors are also faced with the challenges associated with increasing crude oil and natural gas reserves in an environment where the preponderance of global reserves are controlled by national governments. The era of easy oil has indeed ended and the global oil industry is equally challenged by the development of new forms of alternative energies to meet future energy demand.

For national oil companies, the situation is different, but improving. National oil companies are challenged to extract hydrocarbons in an economical manner while supplying revenues to their governments. Therein lays the dichotomy and challenge. National oil companies are perennially faced with providing for the vast majority of their home country's economic resources. Many small national oil companies face a more precarious position of having to continually depend on high crude oil prices.

Are high crude oil prices a phenomenon of the past? While none of us has a crystal ball, the market consensus is that demand for crude and its refined products is going nowhere but up. Therefore, high crude oil prices have returned with a vengeance. How high is high? Over the near term, triple digit crude prices have returned but may not be sustainable over the longer term. The wild card is global economic recovery and returning crude oil demand from the 34-member Organization for Economic Co-operation and Development (OECD) countries. Currently, emerging market economies of China, India, Brazil, and Indonesia are contributing to the growth in crude and natural gas markets. Moreover, these emerging markets are stabilizing crude oil prices and preventing downward pricing pressure.

The natural gas market is currently in a pricing downturn. However, if we look beyond natural gas prices, we see a natural gas sector poised for future growth. Currently, natural gas inventories remain at relatively high levels contributing to the downward pressure on pricing. Natural gas is quickly becoming the fuel of choice as consumers and industries seek to move to greener solutions. Natural gas is becoming the fuel of choice because it is the *cleaner fuel*.

Moreover, unconventional natural gas shales (described more fully in Chapter 8) in the United States are in an unprecedented boom. Producers are seeking to acquire acreage in the U.S. basins of the Marcellus, Bakken, Eagle Ford, Haynesville, and Barnett Shale unconventional natural gas shale plays. According to the U.S. Department of Energy, growth in the U.S. natural gas market has the

propensity to increase proven U.S. natural gas reserves almost three-fold over the next decade as producers aggressively move to categorize unconventional shale gas deposits as proved reserves (see Chapter 6). At the same time, development of these unconventional natural gas shales will have a weakening effect on natural gas prices as new supply comes on-line. The U.S. Department of Energy and producers believe that demand for natural gas will continue to increase over the next decade because of its attractiveness as a clean-burning and attractively-priced fuel. While natural gas continues to grow in the United States, it is a much quieter story outside of the United States.

Production Perspectives

Integrated majors are looking beyond the once-prolific basins of the North Sea and Cantarell in the Gulf of Mexico, or shallower waters of the Gulf of Mexico. Today, the oil and gas industry is exploring in the Arctic Circle, off the west coast of Africa, and in the deep waters of the South Atlantic. The industry is exploring where the engineering and logistical challenges are significant. The engineering feats necessary to explore, develop, and transport fuels in -20°F (-29°C) are not insignificant.

This doesn't consider the costs associated with drilling in harsh environmental conditions. For novices to energy, exploration and production (E&P) represent the single biggest expense to oil and gas companies. Conversely, the E&P side of the business produces the largest portion of the revenues.

Today, most oil and gas production companies face significant production challenges. As basins mature, the integrated majors are not only left to explore in harsh environments but they are in the midst of stable to declining production profiles. Why is that? Independent oil companies do not own most of the oil and gas reserves on the planet. In most countries, governments own the mineral rights associated with oil or gas deposits. The oil and gas laws and regulations vary with each country.

Safety in Deepwater Drilling

Rig workers perform incredibly dangerous work, often in harsh working conditions. Included in the harsh environment is the practice of deepwater drilling. In April 2010, the Transocean-owned Deepwater Horizon platform exploded in the U.S. Gulf of Mexico killing 11 rig workers. Television news programs broadcast the challenges—reminiscent of NASA spacewalks and planetary rovers—of maneuvering heavy equipment in the 5,000 foot-deep waters of the Gulf of Mexico. The world watched as BP p.l.c. (BP) engineers finally capped and plugged the infamous runaway Macondo well in what became the worst oil spill in U.S. history.

The BP oil spill resulted in numerous countries reviewing safety standards and emergency response systems. There is no doubt that renewed or enhanced safety precautions, standards, and emergency response measures are necessary, particularly in deep water-drilling situations.

One of the oil and gas industry's responses to the BP spill was forming and implementing a collective effort to build a containment system to capture oil spilling in deepwater situations. An ExxonMobil-led consortium was formed to respond to such deep water-drilling emergencies. Consortium members, including Shell, Chevron, and Conoco Philips, each contributed US\$250 million to form the joint-venture corporation. We believe that industry-led initiatives aimed at enhancing safety will continue to be put forth.

As authorities continue to sort through the details of this tragic accident, the industry and regulators must take steps to prevent these catastrophes, on behalf of employees, the environment, and regional economies. However, the collateral damage in the industry will be felt for years as sovereigns, municipalities, states, and provinces all over the globe assess deepwater drilling.

One of the most significant repercussions is that of increased regulation of deepwater drilling. Many sovereign nations are reassessing their current safety policies and those of the companies drilling in their waters. Included in this is a review of emergency response systems and the infrastructure necessary to manage a catastrophic drilling event.

Regulators around the globe also have tightened up the process of leasing and permitting new deepwater wells. The U.S. reaction to the oil spill has been to implement a moratorium, shutting down all new deepwater drilling projects. As of this writing, we still do not have an independent assessment of the accident. And while drilling officially reopened in the Gulf of Mexico, to date few drilling permits have been issued.

Many sovereign nations are pursuing deepwater drilling despite the risks. For many countries, deepwater drilling represents economic opportunity and badly needed revenues. By shutting down deepwater drilling, these countries would pay an unacceptable economic price. The best example of this is Brazil. There will be more on Brazil in Chapter 2, Investment Opportunities in Energy.

Importance of Reserves

One of the more significant challenges for an independent oil company (IOC) is growing its reserve base. In Chapter 6, we will review the industry standards for measuring and determining hydrocarbon reserves. Growing the reserve base becomes increasingly complex when one considers that virtually 80 percent of global reserves are owned by state-owned or national oil companies (NOCs). Therein lays the challenge. IOCs must work with NOCs to drill and extract hydrocarbons where sovereign nations own the mineral rights. Several Middle East NOCs are susceptible to geopolitical risk where oil or gas production may be