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THE PROFESSIONAL RISK MANAGERS' GUIDE TO THE ENERGY MARKET

PRMIA

Edited By Peter Fusaro

THE PROFESSIONAL RISK MANAGERS' GUIDE TO THE ENERGY MARKET

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DEDICATION

PRMIA Publications, part of the PRMIA Institute (http://prmia.org/INDEX/institute01/) wishes to express its deepest gratitude to Peter C. Fusaro, our editor, and the authors of the Professional Risk Managers' Guide to Energy and Environmental Markets. The effort required to assemble such a diverse set of authors into a cohesive text is significant. Yet, the publication of this work comes at a time when energy and environmental risks are affecting markets around the world. This book is, therefore, essential reading for all financial risk managers, regardless of their industry focus.

We would also like to thank Richard Leigh, our London-based copy editor, Holly Thesieres, our US-based layout editor and Professor Carol Alexander, the Executive Editor of PRMIA Publications, for their dedication and professional work.

We trust you will find that reading this publication enriches your understanding of these important markets and that this book proves to be an invaluable reference tool for you in the years to come.

David R. Koenig
Executive Director, Professional Risk Managers' International Association (PRMIA).

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CHAPTER 1

Introduction to Energy Financial Risk Management

Peter C. Fusaro

INTRODUCTION

In February 1991, I set up an energy risk management consultancy, Global Change Associates, in New York City. It may have been the first such consultancy. Initially, I concentrated on changes taking place in oil trading and the maturation of the natural gas market. The New York Mercantile Exchange (NYMEX) had launched its Henry Hub natural gas futures on April 4, 1990. It took several years for that contract to become established. The tipping point was when 25 natural gas producers were encouraged to support the nascent contract by providing liquidity. A pioneering oil and gas company executive undertook that effort. She made that contract work!

Previously, the natural gas industry was reluctant to embrace risk management techniques. Producers were reluctant to give upside price appreciation. That changed as gas market prices continued to oscillate, based on pronounced seasonality that still exists today. The better news is that the gas industry made the contract work. That is the key point of energy risk management: the need for energy industry trade participation. It is not enough for knowledgeable money center banks in New York, London, Singapore, and Tokyo to make markets work. Energy risk management requires the active participation of the energy industry.

Today, that industry is still growing, and so are energy risk management techniques. Through organizations such as the Professional Risk Managers' International Association we can see its growth every day.

Oil risk management evolved into gas risk management, now on a global scale. *Electric power risk* management was the next market to evolve. The *weather derivatives* markets followed that. Looming larger than all these markets is the *global environmental financial risk* management market for emissions trading. This market began in March 1995 with the US Environmental Protection Agency auction on the Chicago Board of Trade. This annual auction sets limits on the "cap and trade" for sulfur dioxide (SO_2) emissions that cause acid rain. Market-based solutions for the environment are a natural outgrowth of commodity markets. Today, we have a growing carbon dioxide (CO_2) market that will eventually be bigger than oil market trading. There is an evident cross-commodity market arbitrage with fossil fuel contracts. Trading is developing quickly in this arena too. These are precursors to the growth of the next financial market in *water trading*.

Risk management techniques borrowed from the financial markets have catalyzed both energy and environmental trading. This book is the collective wisdom of many energy and environmental market practitioners. Some of these professionals were pioneers in market development. The intention of this book is to show the evolution, tools, scope, and breadth of the energy and environmental financial markets. For, in mid-2006, we have entered the 26th year of energy financial trading, initiated on the NYMEX in 1978 with a No. 2 heating oil contract. The market remains financially immature with a $2.2 trillion notional value for all outstanding contracts, as estimated by the Energy Hedge Fund Center (www.energyhedgefunds.com). That compares to the $1.5 trillion in daily trade in foreign exchange (Forex).

Energy has a long way to grow, and so do the environmental financial markets. In fact, the entrance of hundreds of energy hedge funds since 2004 is accelerating the financialization of the energy and environmental markets. It is hoped that this handbook will facilitate some of the knowledge transfer and market growth that is needed to manage risk, monetize assets, and apply financial engineering to all parts of the energy and environmental value chain.

The world is ripe for fundamental change in its trading and risk profile. Higher energy prices, deregulation and globalization of markets, technology shifts, and environmental risks have added more price risk than ever before.

ENERGY IS AN IMMATURE FINANCIAL MARKET

The energy markets are changing in many ways, both physical and financial. Trying to trade these markets with old playbooks does not work. We now have trading patterns in markets such as heating oil prices rising above gasoline during June 2005 for the first time ever, and in August 2005, natural gas spiked in before the traditional shoulder period of lower demand due to the *event risk of hurricanes*. The continued run-up in crude, gasoline, heating oil, and natural gas prices during 2006 were harbingers of the future. The energy industry is still too shell-shocked from the price crashes of 1986 and 1998 to even believe it. So, energy companies cough back the profits to investors in dividend boosts and stock buybacks. The new energy hedge fund phenomena will accelerate market transformation.

Another "new" business strategy is to go into financial electricity markets with physical assets. If Goldman Sachs and Bear Stearns both own generation assets, then they must know something. That "something" is price discovery in illiquid markets and the ability to backstop power trades with physical assets. This is a key component of arbitrage strategies. The entrance of Morgan Stanley into the West Coast physical jet fuel market is further evidence that Wall Street is entering the physical markets. The expectations are that money center banks in both New York and Houston as well as energy hedge and private equity funds will continue the movement into the physical energy markets.

The distinction between physical and financial energy markets is starting to blur. The need to own or have an option on physical capacity of oil, gas, or electric power will make this market maturation process different than anyone expects. The new dynamics are faster-trading markets, more intraday price volatility, and more risk. The realization is that energy risk management has become a fiduciary responsibility of energy companies.

THE MARKET DRIVERS OF ENERGY TRADING

While energy trading and the use of energy risk management tools have been slow to evolve in Asian energy trading, that present state of affairs is beginning to change across the board in the energy complex. Driven by energy market deregulation, globalization, and privatization trends in many countries, risk is becoming pervasive. As many Asian countries move toward open markets, competitive forces are coalescing that will

force much more active energy risk management. It can be argued that risk is endemic in market economies. Therefore risk management techniques become the necessary survival skills of Asian corporations. Active energy risk management then becomes a fiduciary responsibility of Asian energy companies. While short-term physical oil trading has always existed in most Asian countries, the energy complex is broadening to include gas, power, petrochemical, coal, and weather risk management. Lurking on the horizon is emissions trading to reduce plant emissions and reduce greenhouse gas emissions.

Asia is primed to embrace the active use of energy derivatives and much more sophisticated trading techniques and financial engineering. Borrowing heavily from the institutional memory of well-developed New York and London capital markets, energy trading and risk management are on an upward trajectory in Asia, fueled by growing oil and gas dependencies and the need for more electric power. Credit risk management, similarly, is an area of exponential growth in Asia. The need to actively manage counterparty risk is highlighted in the wake of the demise of Enron and many US and European trading companies. Deregulation of the electric power industry, in particular, brings these risks into focus.

While paper market trading for oil and gas has grown on both established futures exchanges and the over-the-counter forward markets since the early 1990s; electricity paper trading is still in its infancy. Electricity deregulation has driven the commoditization process, and there is convergence of both gas and electricity that has accelerated much more on the physical side of the market than the financial trading of power. In fact, the relationship of natural gas marketers and electric power marketers cannot be understated. However, power marketing is a more demanding market. It is a next-hour, next-day, next-week, and next-month business. Power marketers and traders provide greater efficiency by buying and selling power and transmissions capacity. Electric power is a 168-hour, seven-days-a-week market that changes prices hourly, half-hourly, or quarter-hourly. It is the most volatile commodity ever created, with price volatility of over 1,000% in some cases.

The transition in the market from monopoly to competitive markets has fundamentally changed how utilities and others buy and sell electricity. The transition to global competitive markets will bring more risk to all involved in the energy complex as well as the emerging environmental risk management complex.

ORGANIZATION OF THIS BOOK

This purpose of this book is to describe the fundamental evolution of energy and environmental trading. We have organized it accordingly:

- *Chapter 2*: Carl Larry of Barclays Capital explains how *energy futures trading* works today.
- *Chapter 3*: Tom James of Deloitte Consulting presents an overview of *over-the-counter derivatives markets*.
- *Chapter 4*: Dr. Steve Leppard of bpriskmanager follows that presentation with more examples of *energy derivatives structures*.
- *Chapter 5*: Per Christer Lund and colleagues give an *exchange's overview of Nordic electricity markets*.
- *Chapters 6 and 7* are collaborative efforts of several risk management experts, Dr. Carlos Blanco, José Ramón Aragonés, Robert Mark, Kevin Dowd, and Warren Murdoch, on *market risk measurement and management for energy firms* and *best practices in credit risk management for energy and commodity derivatives*.
- *Chapters 8 and 9* are two companion chapters on *natural gas trading*. Frank Hayden provides an introduction, and Dr. Mark Houldsworth provides a more advanced treatment of *natural gas structured transactions*.
- *Chapter 10*: We then return to Carlos Blanco, Robert Mark, Kevin Dowd, and Kevin Kremke's chapter on *liquidity risk measurement and management for energy firms*.
- *Chapters 11–15*: These chapters dig deeper into energy risk management tools. First, Tom James discusses the *value of technical analysis in energy markets*. Then Hillary Till of Premia Capital examines *risk management in energy-focused commodity futures investing*. Tom James returns with a discourse on the *ISDA Master Agreement*. Alessandro Mauro then writes about *creation and transfer of price risk in European energy markets*. Finally, Dr. Nedia Miller presents an *introduction to the use of energy options*.
- *Chapter 16*: *Risk management software* is also very important for maintaining the trading book, deal capture, stress testing, and mark to market, as this chapter by Dr. Gary Vasey of Energy and Environment Capital Management, LLC shows.

- *Chapter 17*: Returning to commodity trading, Rob Kristufek and Jason Oakes embark on a chapter on *electricity options*.
- *Chapter 18*: Brian O'Hearne of Swiss Re moves into another market with his chapter on the implementation of a *weather risk management* strategy. Brian is a former head of the Weather Risk Management Association (www.wrma.org).
- *Chapter 19*: Peter C. Fusaro and Tom James give their views on *Asian energy markets*. Together, these authors wrote the first book on Asian energy hedging markets, *Energy Hedging in Asia*, in 2005.
- *Chapters 20–25*: With these chapters the book moves beyond energy risk management. Peter C. Fusaro sets the scene for an examination of *environmental financial trading*. Then Richard Stuebi, who worked on creating the SO_2 trading program, assesses lessons learned from the US experience in *trading SO_2 allowances*. Randall Lack of Element Markets then expands the US emissions trading discussion with a look at *the complexities of trading regional emissions markets*. Carla Tabossi of Innovest Strategic Investors then assesses *climate risks and electric utilities*. Stefano Alaimo expands the theme of environmental financial trading with his chapter on *green, white, and red certificates trading in Italy*. Finally, Ashutosh Shastri provides an overview of *carbon markets*.
- *Chapter 26*: Peter C. Fusaro and Gary Vasey focus on the entrance of *energy hedge funds*.
- *Chapter 27*: The book concludes with a forward-looking chapter on *energy and environmental trading market developments* by Peter C. Fusaro.

CHAPTER 2

Energy Futures Today

Carl Larry

INTRODUCTION

Futures have been around for centuries; for example, in the 1840s in Chicago, producers and buyers were looking for a way to "hedge" agricultural commodities. They sought ways to eliminate price risk during transportation, bad weather, or a sway in demand. The commodity market is now a global marketplace that handles nearly 5 billion futures and options contracts every year. Trillions of dollars are traded on a day-to-day basis, revolutionizing the way we look at risk and how it is handled. Starting with simple hedges, the futures markets have now become one of the main sources of speculative investment activity. The growth from pure physical hedging to speculative trading is no more evident than in the energy futures market.

The energy futures market just a few years ago was a small addition to the larger futures arena. The biggest players in the futures market were the major oil companies, moving oil tankers, and gasoline barges. Futures were the perfect instrument. The price on the futures market was mostly reflective of actual physical demand and supply numbers. After September 11, 2001, however, the world changed—as did the energy futures market in a spectacular way.

During 2001, global events started a domino effect to bring the energy futures market to the forefront of risk management. The election of

George W. Bush brought on a new agenda for America. September 11 shook America's perception of the Middle East and brought to light a dependency on foreign oil. That dependency continues to grow. The collapse of Enron later that year (December) created a larger market interest in energy futures.

The main marketplace for energy futures is the New York Mercantile Exchange (NYMEX). Growth has exploded over the past few years at this exchange. In 2006, NYMEX is expected to increase its trading volume by 24% compared to 2005. On this exchange, crude oil (West Texas Intermediate), natural gas (Henry Hub), unleaded gasoline (New York Harbor), and heating oil (No. 2) are traded. These contracts are specified, based on their grade and delivery points, and are the most commonly used. As we move ahead, we are finding more interest in other contracts that are of different specifications, although most of the liquidity stays within these four successful contracts.

In the future, as we continue to grow on a global scale, we will find ourselves trading more area-specific contracts such as Dubai Brent crude, European diesel fuels, and Asian fuel oil. Since the futures market will always be primarily used for physical hedges, the growth of these markets is inevitable. The emergence of foreign countries as economic powers consuming more energy will prompt the move of futures trading to their own demographic purposes.

FUTURES: WHERE'S THE RISK?

Over the past few years, energy futures have been accepted more favorably by the global energy industry. They have developed well as valuable risk management tools. In the past they were locked in to hedge physical energy movements across the globe. Oil companies from America to Asia were in some form or another using these markets to lock in a solid amount of profit or loss. Through the volatile times of political unrest, weather complications, and physical disruptions, energy futures provided some relief and price protection for both oil producers and consumers. As the global economies started to recover, a shift started in commodity futures. More speculative funds were now looking to use these futures to hedge economic strength and direction.

Funds, included as "large speculators" in the weekly US Commodity Futures Trading Commission's Commitment of Traders report, have been growing quickly, and their participation in the futures markets has

changed the risk factors. The combination of these funds and their focus on economic impact has increased the importance of energy. Once overlooked as a purely physical market, they are now regarded as economic indicators as well as a natural inflationary hedge. Energy is now noticed by the global financial community.

With the fall of Enron in December 2001, a temporary void was left. As with most arbitrage opportunities, this gap was soon filled. The thought was that another physical producer would step in. However, financial firms were concerned about providing financial backing. The financially savvy realized that the market was open to all players, including those with money and an appetite for alternative investment. Soon, large hedge funds started following commodity indexes, hedging oil versus inherent foreign exchange risks and inflationary interest rate moves. Once deemed the "market of cowboys," it had now become the "smart money market."

During this shift, energy futures grew in daily volume, open interest, and price volatility. Along the way, producers were sometimes stymied with irrational moves. To a physical trader, a $2.00 move in crude oil futures had meant a major physical disruption: a broken pipeline or ship that had failed to deliver. What was beginning to happen was this: the growth in futures was being increasingly dominated by pure financial interests. During these years the physical market was slow to follow the growth that these large financial investors were seeing. They had been watching the financial markets of the world and had seen that within the next few years, economies would do what they are supposed to do: grow. The pattern was obvious, but for many who physically judged by what was "on the water," the futures market was becoming irrational.

Many traditional hedgers in the US were caught as off guard, as were the international oil organizations. The International Energy Agency in Paris and OPEC were continually quoted in the financial press as being puzzled over large gains in the American energy futures markets. To make a point about how much OPEC was unprepared for the new focus of energy futures, we can look at the average disparity between the OPEC basket price (an average of oil prices from OPEC members and Mexico) and the NYMEX market (Table 2.1).

The physical fundamentals had not changed much year on year, but the economics of the world had. Demand was now the main risk factor. Smart money was hedging and trading. Seasonal factors are still a part of the way oil products trade but are now complicated by how these new traders view mitigating issues.

TABLE 2.1

Yearly average OPEC basket and NYMEX price (US dollars)

	OPEC Basket Price	NYMEX Price	Difference
2002	$24.36	$26.15	+1.79
2003	$28.10	$30.99	+1.89
2004	$36.05	$41.46	+5.41
2005*	$47.31	$53.52	+6.21

*Average as of September 2005.

Source: OPEC, NYMEX.

In America, we have not had a new refinery built since 1976. Did no one thinkwe would outgrow this supply capacity constraint? The futures market's growth has become a passing of the torch to a new era of oil trading and analyzing risk. The new generation of currency, interest rate, and economic growth was now being factored into risk equations. Current prices have premium added in to compensate for these factors.

RISK PREMIUMS

Over the past few years, as crude oil prices have moved from a $10 to $20 range to a $50 to $70 range, there has been much discussion about value-added "premiums." As the USA began to discuss military operations to invade Iraq in 2002, the oil markets started to rise in anticipation. Soon, as prices started to float above $30, many oil fundamentalists were talking about a "war premium." Since demand was only growing slowly post-9/11, the grind higher was blamed on this premium. As justified as it was at the time, the analysts were underestimating the real reason why these future prices found higher ground: demand growth. Many had stated that futures were holding war premiums as high as $10 to $15. As the threat of oil disruptions started to diminish, the so-called premiums never left the oil markets.

During this time, a new global demand dynamic was forming. Demand from China seemed to have taken the world by surprise; a country that was becoming one of the largest economies in the world seemed to emerge from nowhere. Should this really have been a shock? Chinese demand was now the new "premium" and, subsequently, another addition

to the skyrocketing futures prices. Funds trading on economic trends caught on to the wave and were entrenched in a profitable uptrend for the futures market.

Most were busy pointing fingers at such premiums, while the US economy was continuing to recover from a period of recession. Overall oil demand was growing at 3% per year from 2002 to 2004. This increased demand was starting to make an impact on the supply picture. With this increase, the amount of imported oil products also jumped. These numbers were coming in at a record pace, and as they did, the need to hedge their risk became more important. Risk management for oil became more complex, and energy futures trading was starting to grow because of this. Commercial producers, funds, and financial institutions that were backing these players were now hedging their risk exposure to the emerging commodity markets. A new era of market participants was defining the oil trading markets. The difference now was the fundamentals of the markets. Physical oil movements were still a concern, but what these other participants were watching was as important.

THE NEW MARKET FUNDAMENTALS

Since the development of the NYMEX crude oil contract in 1983, most of the more important market fundamentals were based on physical activity. Supply was always deemed abundant. Demand was never at a threat to domestic supply. Imports were used almost exclusively as a price barometer. Weather was factored as only affecting winter fuels. Hedge funds that were active in oil futures were easily outnumbered by the commercial participants and were only a small part of market movements.

In 1995, crude oil futures had an average of 122 commercial participants. This number compared with an average of only 60 funds in the crude futures market. By the fall of 2005, the number of funds involved exploded to an average of 234 in contrast to an average of 169 commercials, according to the Commitment of Traders report. The basis of what these two different types of speculators were looking at was changing the basic risk fundamentals.

Physical risks were mainly grouped into domestic and foreign issues. In the USA, pipeline issues would cause price activity. A problem with delivery of oil to its destination because of pipeline issues would cause the deliverable futures contract to react accordingly. Another common disruption that would move markets is refinery disruption or

delivery problems with a gasoline barge. In fact, today, refinery issues have been more common as aging American refineries are put under further stress trying to stretch production. These events drive energy markets.

Winter fuel markets would run rampant during colder-than-normal winters. Other weather conditions that would mainly affect winter fuels were hurricanes. Just a few years ago, the main concern with hurricanes was the disruption of natural gas pipelines. In recent years the ferocity of hurricanes has put both natural gas supply and the limited crude production in the Gulf Coast at risk. US dependency on domestic supply has become more crucial as our demand continues to grow. Refineries have also become at risk during these hurricanes. As with all of the oil supply in America, every bit of lost oil supply has caused volatile swings in the energy markets due to the supply tightness of these markets.

The new era of futures fundamentals now includes economic and geopolitical risk. The strength of the world economies has increased demand everywhere. Chinese demand was brought under the spotlight as an unforeseen demand factor. The fact that several other Asian countries had started to show signs of economic recovery was overlooked. India, Korea, and the Philippines are just three of the countries that were gaining ground economically and whose oil demand was increasing. Adding to the peaking supply and demand picture in the Asian region, Indonesia (a regional supplier) was dealing with a crumbling oil infrastructure and declining resources.

Risk management in these Asian countries had now added a new ingredient to their economic core value. Currency values continued to be measured against the US dollar but could also be hedged against money spent in and on oil products. Funds that were investing in Asian economies could add oil futures to help stabilize risk. This model could then be duplicated in emerging markets in OPEC member countries, Latin American oil-producing countries, and Russia. The usefulness of this concept is that no oil product could ever go to zero. Oil would always have value, and risk could be managed with the respective futures markets.

In the USA, major oil statistics were released weekly. There are two reporting agencies for oil reporting: the US Department of Energy and the American Petroleum Institute, the oil industry's trade association. These statistics remain significant and are widely scrutinized by funds and commercial oil traders. The new dynamic of searching these statistics now is trying to find the economic reflection on demand, rather than supply. Over the past few years the supply picture has become more dependent on imports of all products.

In 2000 US crude oil imports were averaging just over 9 million barrels per day (b/d). By 2005, this had risen to 10.1 million b/d. In real money terms, that would equate to an increase of approximately $53 billion dollars paid for foreign oil. The opportunities to hedge new oil money for domestic purposes and to hedge country risk had become more apparent. From speculative funds to financial institutions that were backing oil dollars, risk management and their respective tools were getting a new audience and interest.

Connecting the dots, economic releases that were once of interest to those concerned with financial risk management now had an impact on oil markets. Demand could be traced to strong employment numbers. Retail sales numbers that had moved the retail equity market now ignited ideas to hedge transportation fuels. The heating oil futures that were mainly of concern to US East Coast homeowners in winter seasons now attracted interest from those trying to manage jet and diesel fuels. Federal Reserve rates were now of utmost importance to large oil companies who needed to focus their available cash reserves while holding oil that had risen in price by nearly $30 over three years.

Another new dynamic that has become a risk factor in the energy markets is geopolitical risk. In the aftermath of 9/11, foreign activities are more closely scrutinized. The US invasion of Iraq caused oil markets to run above $40 but has only been part of the reason they continued to climb. During the invasion, the biggest fear was that the oil fields in Iraq would be sabotaged beyond recovery. The unfolding circumstances during America's tenure in Iraq yielded problems that were unforeseen. The worst-case scenario of Saddam Hussein blowing up the oil fields was unfounded, but the oil infrastructure in Iraq was worse than believed. Also during the following months, there were attacks on oil pipelines, but the effect was not as important as the weakened infrastructure. Many oil experts predicted that by 2006, Iraq would be pumping well over 3 million b/d, with some guessing as high as 5 million.

As oil pipelines in Iraq became common targets for terrorists, the idea that bigger installations would be targeted added tension to the markets. This added more risk premium to the futures prices, which was followed by more media hype. With talk of terrorist attacks, Middle Eastern fears became more prevalent, and the media started covering these events alongside the oil movements. The next fundamental of new oil trading was about to be uncovered: the media.

Starting with the stock market boom in the 1990s, 24-hour news coverage and Internet news gave the markets and investors more accessibility

to trading. The oil markets had become newsworthy. They involved Middle East attacks, foreign oil, and economic growth and affected the common public consumer. America was becoming environmentally aware. The hybrid car was not only an environmental statement, but also a way to save money! Gasoline prices were at a record high. Daily news broadcasts made the public aware of the reasons behind the oil market prices. Oil trading was now in vogue with large investors, financial institutions, commercials, and a growing number of small speculators.

THE FUTURE OF ENERGY FUTURES

With the explosion and exposure of oil futures markets, the bevy of new participants was looking for ways to manage this risk. The NYMEX is the epicenter of oil futures markets. The open interest at this exchange was expanding quickly, as did its volatility. Instead of markets moving in "tics," minimum price fluctuations, they were moving in waves of uptrends and downswings. The volume that was being traded was more than anyone on the floor had been used to seeing on a day-to-day basis. This was a boon to the NYMEX and its members, but the market price itself was acting erratically.

From 2004 to 2005 NYMEX volume had grown over 24%, and open interest was making records in their products.[1] The NYMEX seat price has set a record for any futures exchange in November 2005 at $3.77 million. This number is a far cry from 2000, when a seat had set a record sale at $755,000.[2] Obviously, over the past five years the interest in oil futures trading has been peaking. The question facing us is how much more this development can continue. The oil futures market has been exclusive to the NYMEX for years. Only the International Petroleum Exchange (IPE) in London has been able to catch any market share over the past few years.

The IPE has been trading the benchmark Brent oil contract since 1988. Consistent with other futures exchanges, the IPE had been trading on an open outcry system (floor trading). In April 2005, the IPE took a new direction in oil futures trading and ended open outcry. This was a radical step for many oil traders, many of whom were just getting used to electronic messaging systems. The idea now was to be able to put the trader in front of the trade. Gone were arguments of volume discrepancies and trades that would be through established bids and offers. From a brokerage perspective, the argument was taken out of the equation. Transparency was obvious, and trading became much more efficient.

Many traditionalists argued that this would bring the end of liquidity and emotion. The reality was that many of the new era of traders were patiently waiting for this. Futures volume on the IPE, now called the Intercontinental Exchange (ICE), soared. Several records such as daily (295,501 during August 2005) and monthly (4,181,450 in September 2005) volumes were set after the IPE moved to an electronic platform.[3] Moving trading to an electronic market also allowed more sophisticated traders to set their trading systems to trade automatically. This gave traders more freedom and meant they need not be so concerned about slippage and human error.

The ICE also started a shift in "over the counter" (OTC) markets. As more established financial institutions and higher prices in energy became more established, the unregulated OTC market became more of a risk. Creditworthiness became important, and the ICE (along with the NYMEX) introduced a slate of OTC products that were backed by the London Clearing House. These hybrid futures contracts would become a boon for both exchanges. In the first year alone the ICE had traded over 1 million contracts via its OTC futures system. These contracts were mainly traded by an outside broker matching two sides of a product. Since their inception, these contracts are still mainly traded by this process but have evolved into open markets in some products.

In 2002 the NYMEX also entered this OTC clearing trading market. In similar fashion the NYMEX Clearport system developed into a high-volume trading platform. In 2004, over 12 million contracts were traded on the Clearport platform. In September 2005 the daily volume record was set at 286,146 for Clearport trading. The evolution of electronic trading is happening and continues to develop. The effectiveness of a nearly 24-hour market provides accessibility to all regions and their time zones. As discovered years earlier by the Chicago Mercantile Exchange and its conversion to electronic markets, the world doesn't trade at the same time.

Further evidence of the change in the market mentality has been the new e-miNY contracts for crude oil and natural gas. These contracts, introduced in 2002, have increased volume and open interest each successive year. In November 2005 the e-miNY contract had cleared over 5 million contracts, and daily volume had hit a record of 64,784. New investors and traders were finding the ease and availability of this half-sized contract comfortable.

By 2006 the availability of electronic oil markets seemed ready to explode. In Dubai the NYMEX already had plans to establish an open

outcry exchange for oil futures. It will have competition from the Dubai Commodity Exchange, which plans to launch its electronic fuel oil futures contract. NYMEX Europe has set forth plans to trade an electronic contract alongside its struggling open outcry futures venture. Competition in the expanding oil futures market is great. The tools of risk management could become more region-specific. With more exchanges turning to an electronic marketplace, risk can easily be measured by the deliverability of the contract and the creditworthiness of the respective exchange.

Energy futures have become an instrument to hedge physical barrels, financial outlooks, and foreign investment. Hedging has become optimized to include the commodity markets. Oil is a major part of this investment. Over one year we have seen trading volume in energy increase by 15% and in the USA alone by 32%. These numbers will continue to increase as the liquidity and diversity of energy markets expand.

NOTES

1. Futures Industry Association.
2. NYMEX.
3. ICE.

CHAPTER 3

Overview of the Over-the-Counter Energy Derivatives Market

Tom James

INTRODUCTION

The financial energy markets have undergone a rapid transformation since the early 1990s. This chapter provides a general overview of the mechanics and participants of over-the-counter (OTC) energy trading, focusing on natural gas and crude oil. It puts into context the current state of the OTC energy markets by outlining the history of energy trading. The general use of and terminology associated with these markets are defined, and the most common types of energy derivatives and pricing models are described. Examples are given to illustrate how OTC derivatives are traded and how the derivatives apply to hedging energy production and consumption.

Oil companies, refineries, trading firms, and other intermediaries that are engaged in the physical trading of petroleum and petroleum products are exposed to market prices. The profit structure of many companies is highly unstable, owing to market price volatility. Hedging with derivatives is a method to offset risks caused by petroleum trading and to stabilize earnings. The goal of any hedging program is to help companies achieve the optimal risk profile that balances the benefits of protection against the costs of hedging. OTC markets allow companies a flexible way to hedge their exposure.

OVERVIEW OF ENERGY MARKETS

The scope and scale of financial derivatives trading in energy markets around the world has broadened dramatically since the early 1990s. The market was in its infancy when the New York Mercantile Exchange (NYMEX) launched the No. 2 heating oil contract in 1978. Today, traders are able to trade around the clock, almost seven days a week, via electronic platforms such as the Intercontinental Exchange and the NYMEX.

In the energy industry, derivatives can be bought and sold in two main ways: on an exchange and over the counter. The former refers to the futures markets, which are found on regulated financial exchanges such the NYMEX and London's ICE Futures (formerly called the International Petroleum Exchange or IPE, and owned by the Intercontinental Exchange). The OTC market is specific to the non-standardized price swaps and OTC options. These are usually traded directly between two companies (principals, players) in the energy markets.

Although the futures markets are important to the energy industry, it relies much more heavily on OTC derivatives. This is because OTC derivatives are customized transactions, whereas their on-exchange counterpart, the "futures" contract, is a standardized contract. In theory, each deal on the OTC market is unique, so it is important to be alert to contract terms, pricing mechanisms, and price reference when using OTC derivatives. Some companies find that the measurement and control of risks can be more difficult with an OTC contract because of the lack of price and liquidity transparency in the OTC market (unlike regulated futures exchanges, which publish public real-time price data), and this can create the possibility of an unexpected loss. There are also sometimes additional legal, credit, and operational risks with OTC derivatives compared to on-exchange futures contracts. However, the OTC market remains a popular option for price risk management purposes. Many companies find that there are benefits in the flexibility of an OTC derivative because it can be valued against the same price reference as the energy which is being produced or consumed.

Generally, all the key terms of an OTC derivatives deal are negotiable, which means that the pricing reference, the payment terms, and the volume can all be adjusted to suit the counterparties to the deal. This is a benefit if an organization has a very specialized or unique price risk which requires a one-off hedging tool. Basically, anything is possible in the OTC energy markets, although, of course, the price of the derivative instrument

quoted to suit a customer's precise and perhaps esoteric needs may not always be attractive. Fortunately, for risk management purposes, the core energy markets, such as the larger oil, gas, and electricity (power) markets, have some active and fairly standardized OTC contracts. They are standard both in their floating price reference and in the sort of minimum contract volume that would normally be traded. Indeed, the increasing standardization in the plain vanilla OTC markets has led to the development of a number of electronic trading platforms.

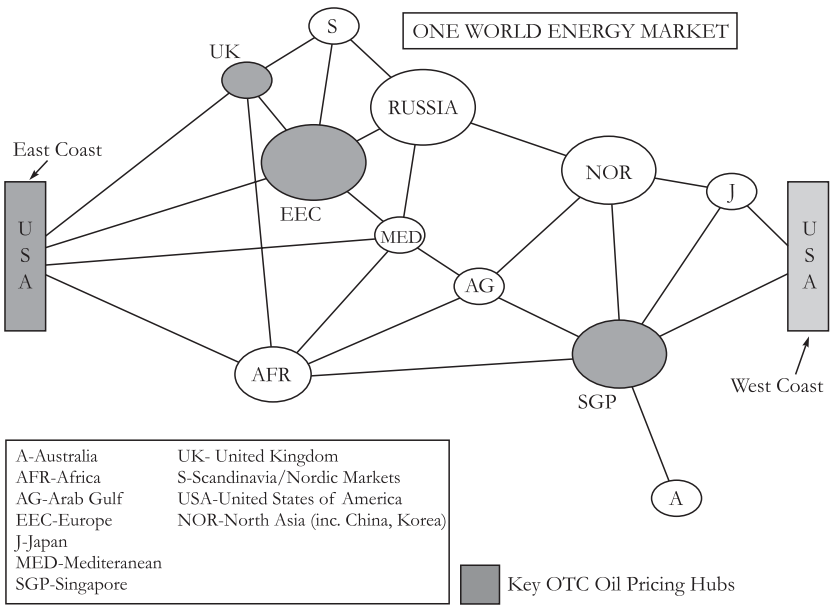
People often ask why regulated futures exchanges seem to be unable to launch new petroleum futures contracts. The answer is that the needs of the market are already being met by the now well-established and liquid OTC derivatives market. Another supporting factor of this observation is that futures exchanges have been successful in launching futures contracts in both the natural gas and power markets. The reason for this is that the regulated futures markets were launched soon after deregulation, before or at the same time as an OTC market was establishing itself.

Energy OTC derivatives markets are far less liquid than most other financial derivatives markets such as interest rate or foreign exchange swaps, accounting for less than 1% of the value outstanding on derivatives markets worldwide. This means that those who take part in energy markets, whether as market makers, traders, or end-users (usually companies with underlying price risk in the energy being hedged either as a producer or consumer), need to have clear policies for derivatives usage, including strong management controls and organizational reporting structures, before derivatives are employed. They should also provide shareholders with information that will put to rest any unjustified fears associated with their company's use of derivatives. Indeed, as a result of the concerns of regulators and public shareholders around the world, more and more information is now required by international accounting standards.

The vast majority of physical transactions and OTC swaps are priced using an industry-recognized publication—*Platts*, which is a division of McGraw-Hill. *Platts* publishes a daily assessment of the price of any given crude oil or oil product in any given location, according to its own specifications, and also publishes an assessment of the forward curve. These daily value assessments are based on the aggregated bids and offers from many brokers and dealers around the world during a specified time window for each geographic region—usually toward the end of each business day in each major time zone: Asia (Singapore), Europe (London), and the US (New York, and then the West Coast) (Figure 3.1).

FIGURE 3.1

Main oil OTC trading/pricing hubs. Asia: Singapore is the main pricing hub. *Europe*: Mediterranean, Arabian Gulf, northwest Europe (NWE), and Amsterdam-Rotterdam-Antwerp (ARA) are the main pricing hubs. *USA*: New York Harbor, US Gulf Coast, US West Coast (LA Pipeline) are some international reference points for oil markets



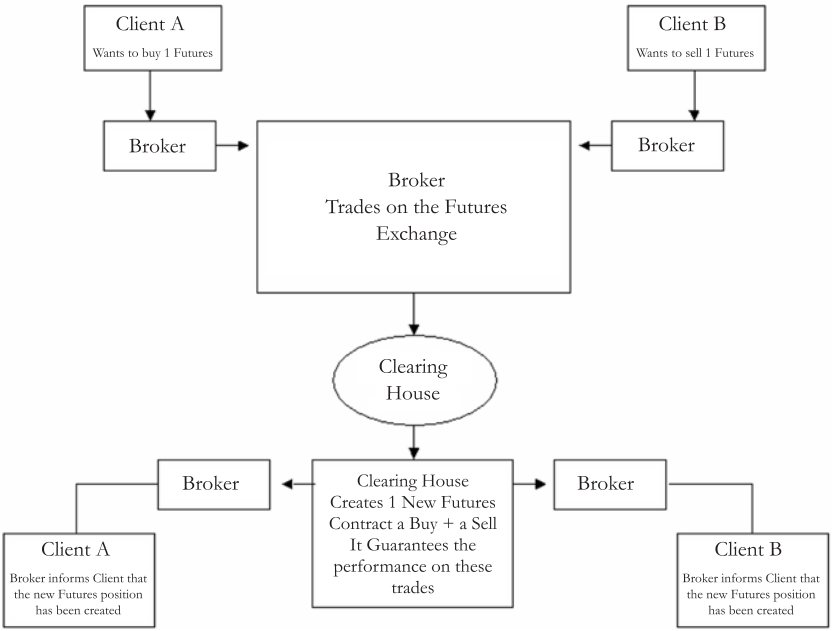
Price swaps are usually priced off the monthly average of these *Platts* assessments and lead to a monthly financial payment equivalent to the difference between the traded fixed price and the calculated average floating price multiplied by the contractual monthly quantity. Only the difference is paid, and there is no exchange of physical energy, and hence no delivery risk.

OTC TRADING

At one time, it was easy to distinguish the futures market from the OTC market and also to establish the pros and cons of using one or the other. As Figure 3.2 shows, when a risk manager or trader used futures contracts, they knew that the contract would be traded on an exchange, that they

FIGURE 3.2

Basic futures trade transaction flow



would have an account with their futures broker, and that they were operating in a highly regulated market. They could also see the price of the contract on a screen, and they could be sure that the security of the contract and its performance would be guaranteed by the clearinghouse of the exchange. This in turn was guaranteed by "margins" (good faith payments by everyone with a futures position on that particular exchange), plus the funding the exchange raised itself and the funds contributed by its clearing broker members.

Margins on a futures exchange can be split into two types: "initial margins" and "variation margins." Initial margins are the good faith deposit that is placed with the clearinghouse or that a broker finances (at a cost) when a trade is opened. Variation margin is the daily revaluation of a portfolio with the clearinghouse. If the valuation is negative, your broker or you (if you have a credit line) will have to place a margin to cover that negative variation margin. If the next day, the portfolio has a positive variation margin (i.e. it is showing an unrealized profit) because

the position has not yet been traded or closed out, some of that margin will be returned.

However, when OTC contracts are used, there is always the credit risk of the other company in the transaction as well as a liquidity risk and a lack of price transparency because there is no screen to display a real-time price.

OTC INSTRUMENTS

Over-the-counter derivatives fall into two categories: swaps and options.

A swap is a contractual agreement entered into between two counterparties, under which each agrees to make periodic payments to the other for an agreed period of time based upon a notional amount of volume. Swaps are financially or cash settled, as opposed to physically settled. This means the actual cash amounts are wired between accounts periodically, typically at month's end. No physical delivery of the commodity is required.

In the most common type of commodity swap one party to the transaction will pay a fixed price, while the other party agrees to pay a floating price. The fixed price payer (floating price seller) is the buyer of the swap. Conversely, the fixed price seller (floating price buyer) is the seller of the swap.

There are a number of issues that must be considered when a party decides to enter into a swap. These issues include the credit quality of the counterparty, the price rate, the pricing index used, payment dates, and payment frequency.

Oil and gas price swaps are usually denominated in dollars. In the crude oil markets, prices are typically denominated in US dollars per barrel. In the natural gas markets, natural gas futures are for delivery of natural gas most commonly benchmarked against Henry Hub spot prices in Louisiana. Prices are quoted in US dollars and cents per million BTU. The contract symbol for Henry Hub natural gas traded on the NYMEX is "NG."

Natural gas prices are highly seasonal. Winter prices typically exceed summer prices because of increased demand during cold weather days. The result is a "peak and valley" pattern. Natural gas prices typically trade up to 10 years forward. For example, in 2006, traders show prices for tenors from 2006 to 2016, and sometimes beyond. OTC trades are done either as calendar strips, summer strips, or winter strips.[1]

Turning to options, plain vanilla American and European options are well understood and widely used in the energy financial markets.