1. Introduction

Purpose of the Report

Derivatives are financial instruments (contracts) that do not represent ownership rights in any asset but, rather, derive their value from the value of some other underlying commodity or other asset. When used prudently, derivatives are efficient and effective tools for isolating financial risk and "hedging" to reduce exposure to risk.

Although derivatives have been used in American agriculture since the mid-1800s and are a mainstay of international currency and interest rate markets, their use in domestic energy industries has come about only in the past 20 years with energy price deregulation. Under regulation, domestic petroleum, natural gas, and electricity prices were set by regulators and infrequently changed. Deregulation revealed that energy prices are among the most volatile of all commodities. Widely varying prices encouraged consumers to find ways to protect their budgets; producers looked for ways to stabilize cash flow.

Derivative contracts transfer risk, especially price risk, to those who are able and willing to bear it. How they transfer risk is complicated and frequently misinterpreted. Derivatives have also been associated with some spectacular financial failures and with dubious financial reporting.

The Energy Information Administration prepared this report at the direction of the Secretary of Energy to provide energy policymakers with information for their assessment of the merits of derivatives for managing risk in energy industries.[1] In accord with the Secretary's direction, this report specifically includes:

- A description of energy risk management tools
- A description of exchanges and mechanisms for trading energy contracts
- Exploration of the varied uses of energy risk management tools
- Discussion of the impediments to the development of energy risk management tools
- Analysis of energy price volatility relative to other commodities
- Review of the current regulatory structure for energy derivatives markets
- A survey of the literature on energy derivatives and trading.

It also indicates how policy decisions that affect energy markets can limit or enhance the usefulness of derivatives as tools for risk management.

Findings

The past 25 years have seen a revolution in academic understanding and practical management of risk in economic affairs. Businesses and consumers are increasingly isolating particular risks and using derivative contracts to transfer risk to others who profit by bearing it. Normally, both parties to a derivative contract are better off as a result. For example, a local distribution company that sells natural gas to end users may be concerned in the spring that the wholesale price of natural gas in the following winter will be too high to allow for a reasonable profit on retail sales to customers. The company may therefore "hedge" against the possibility of high winter prices by entering into a forward or futures contract for wholesale gas purchases at a guaranteed fixed price. The seller of the contract would profit if the distribution company's fears were not realized. Both parties would be better off, because each would accept only those risks that it was willing and able to bear.

Nothing is new in using derivative contracts to manage particular risks. What is new is that global competition, flexible exchange rates, price deregulation, and the growth of spot (cash) markets have exposed more market participants to large financial risks. Simultaneously, advances in information technology and computation have allowed traders to assign a value (price) to risk by using formulas developed by academics starting in the 1960s.[2] Starting from the late 1960s, the business of isolating, packaging, and selling specific risks has become a multi-trillion dollar industry.

Price risk management is relatively new to the domestic petroleum, natural gas, and electricity industries. Electricity has not been a thoroughly competitive industry since the early 1900s. Natural gas and oil pipelines and residential natural gas prices (in most areas) still are regulated. Operating under government protection, these industries had little need for risk management before

[1]Memo from Secretary of Energy Spencer Abraham to Acting EIA Administrator Mary J. Hutzler (February 8, 2002). See Appendix A.

[2]See the Nobel Prize address by Myron S. Scholes, delivered in Stockholm, Sweden, on December 9, 1997, reprinted in *American Economic Review*, Vol. 88, No. 3 (June 1998), pp. 350-370.

the wave of deregulation that began in the 1980s—about the same time that modern risk management tools came into practice.

Derivatives, properly used, are generally found to be beneficial. They can allow a firm to invest in worthwhile projects that it otherwise would forgo. In addition, they neither increase volatility in spot markets nor have been shown historically in oil markets to be a major tool for market manipulation.

Energy policy affects derivatives mainly through its impacts on the underlying commodity and transportation (transmission) markets. Commodity markets with large numbers of informed buyers and sellers, each with multiple means of moving the commodity to where it is needed, support competitive prices. Derivatives for managing local price risks can then be based on the overall market price with relatively small, predictable adjustments for moving the commodity to local users. Federal energy policy has a significant impact on competitors' access to transportation (transmission), on the volatility of transmission charges, and therefore on derivative markets.

Price risk managers in natural gas markets, for example, have to contend with frequent, unexpected, and large changes in the difference between prices in physically connected markets. The effect of highly variable price spreads—the transmission charge—between areas is to subdivide the national market into multiple small pricing hubs. New pipeline construction and capacity additions should eventually promote more competition in the markets they serve by relieving the congestion that may account for some of the variation in price spreads. Until then, market fragmentation will make it hard and relatively expensive to protect against local price variation.

The prospects for the growth of an active electricity derivatives market are tied to the course of industry restructuring. Until the electricity spot markets work well, the prospects for electricity derivatives are limited. FERC is undertaking massive efforts to promote competitive pricing and better integration of electricity markets across political boundaries. In 1999 FERC issued order 2000 requiring wholesale market participants to join regional transmission organizations (RTOs) to establish regional transmission management. Progress in establishing RTOs has been slow. In July 2002 FERC followed up with a Notice of Proposed Rulemaking to establish a Standard Market Design (SMD) that would apply within and across RTOs.[3] Within each RTO the business and operating rules would be the same for all market participants, and all the RTOs would be encouraged to adopt a standard market design, so that the basic rules and regulations of the regional markets would be similar from one RTO to another. Essentially the idea is to encourage a common market for electricity to replace the balkanized industry that exists today. If these efforts succeed, the result should be larger, more competitive regional markets and more cost-reducing trades across areas.

Although derivatives meet legitimate needs, they have also been implicated in tremendous losses. For example, Orange County, California, lost $1.7 billion in 1993; Metallgesellschaft lost about $1.3 billion in 1993 in energy trading; and in 1998 the Federal Reserve Bank of New York organized a rescue of Long Term Capital Management in order to avoid disrupting international capital markets. And in 2001 Enron became at that time the largest bankruptcy in American history. Enron was a large user and promoter of derivative contracts. Although Enron's failure was not caused by derivatives, its demise raised significant concerns about counterparty (credit) risk and financial reporting in many energy companies.

Organization of the Report

This report is presented in two parts. Chapters 2 through 5 focus on general tools for risk management and their use in the oil and gas and electricity industries. Chapter 2 introduces the basic kinds of derivatives and describes their use in managing the price risks endemic to the energy industry. Chapters 3 and 4 are case studies of derivatives in the oil and natural gas industries and the electricity industry, respectively. Chapter 5 examines the potential for further development of these energy derivatives markets.

The second part of the report, Chapters 6 through 8, examines the more general role of derivatives in the economy. Chapter 6 documents the enormous growth of derivative markets worldwide, discusses the markets where they are priced, and describes how derivatives are regulated in the United States. Chapter 7 provides a primer on accounting for derivatives, highlighting Statement 133 of the Financial Accounting Standards Board (FASB), "Accounting for Derivative Instruments and Hedging Activities." Chapter 8 summarizes the published literature (primarily academic) on the overall economic impacts of derivatives.

[3]See Federal Energy Regulatory Commission, "Commission Proposes New Foundation for Bulk Power Markets with Clear, Standardized Rules and Vigilant Oversight," News Release (July 31, 2002), Docket No. RM01-12-000 and Attachments (Questions and Answers), web site www.ferc.fed.us.