U.S. Energy Markets - Volume I: Natural Gas

An Online Continuing Education Course for Engineers

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Introduction

The primary energy markets in the United States are: Natural gas, electricity, and crude oil. These products are regulated by the Federal Energy Regulatory Commission (FERC) pursuant to its authority under the Natural Gas Act, the Federal Power Act, and the Interstate Commerce Act. This series of courses explores the workings of the wholesale markets for these forms of energy, as well as energy-related financial markets.

Energy markets consist of both physical and financial elements. The physical markets contain the natural resources, infrastructure, institutions, and market participants involved in producing energy and delivering it to consumers. The financial markets include the buying and selling of financial instruments that derive value from the price of the physical commodity. These financial markets have their own set of market structures and institutions, market participants, and traded products which have their own drivers of supply and demand. In general, physical and financial markets can be distinguished by the products and by the intentions of the market participants involved.

Much of the wholesale natural gas and electric power industry in the United States trade competitively, while some markets are *rate regulated* where their prices are established through administrative processes based on the cost of providing service. In competitive markets, prices are largely driven by the economic concepts of supply and demand. Underlying the supply and demand for energy are physical fundamentals - the physical realities of how markets produce and deliver energy to consumers and how they form prices.

Market participants buy and sell energy-based *financial contracts* for several reasons. Physical market participants, such as producers and large consumers, usually use financial contracts to manage price risk and to protect against price volatility. That is, financial contracts can serve as a tool for managing risk akin to insurance. Other market participants use the energy markets to speculate or to assume a market risk in the hope of profiting from market fluctuations. Additionally, companies turn to the capital markets if they need to raise or invest money.

This course is Volume I of a five-volume series of courses about the U.S. energy markets. This volume is comprised of seven chapters. Chapter One provides a broad overview of the U.S. natural gas market. Chapter Two describes the demand for natural gas in the residential, commercial, industrial, and electric generation sectors. Chapter Three explains how the supply of natural gas is determined. Chapter Four looks at the Liquefied Natural Gas market for both imports and exports of L.N.G. Processing and Transportation of natural gas are covered in Chapter Five, and Chapter Six addresses natural gas storage. Chapter Seven explains the natural gas financial market.

The following text box describes the entire series.

U.S. Energy Markets

Volume I explores the fundamentals of the wholesale natural gas markets.

Volume II describes the fundamentals of the wholesale electricity markets.

Volume III explains the fundamentals of the U.S. crude oil and petroleum products markets.

Volume IV describes the U.S. Coal Market.

Volume V explores the market participants, products, market mechanisms and trading at work for natural gas and electricity in the financial markets as well as examples of market manipulation that may occur.

Chapter 1
Natural Gas Industry

Natural gas markets have a significant effect on the economy and on the individuals who rely on fuel for electric generation, manufacturing, heating, cooking, and other purposes.

Natural gas supplies approximately 29 percent of the energy used in the United States, or about 27 trillion cubic feet (Tcf) of gas a year.

The Federal Energy Regulatory Commission (FERC) has jurisdiction over the transportation and sale of natural gas in interstate commerce and the companies engaged in those activities.

Natural Gas Units

- MMBTU – One million BTUs.
- Therm = 100,000 BTUs.
- Scf – Standard Cubic Foot is one cubic foot of gas is 1,030 BTU's.
- Mcf – An Mcf is 1,030,000 BTUs.
- Tcf –Trillion Cubic Feet.

The natural gas market is an amalgamation of several subsidiary markets. As mentioned in the introduction, there is a physical market in which natural gas is produced, transported, stored, and consumed. There is also a financial market in which physical natural gas is bought and sold as a financial product derived from physical natural gas. Natural gas markets are also regional, with prices for natural gas varying with the demand characteristics of the market and the regions' access to different supply basins, pipelines, and storage facilities.

Natural Gas

Natural gas is primarily methane, which is a molecule made of one carbon atom and four hydrogen atoms (CH_4) and is among the materials known as hydrocarbons. Natural gas is colorless and odorless in its pure natural form but is often odorized with mercaptan or other odorants to allow for easy detection. It is also highly combustible, giving off a great deal of

energy and fewer emissions than fuels such as coal and oil. Natural gas occurs in geological formations in one of four forms:

- Gas phase associated with crude oil,
- Gas dissolved in the crude oil,
- Gas phase is not associated with any significant crude oil, or
- Supercritical fluid.

Natural gas is considered *wet* if it co *plant liquids* (NGPL) – e. st, natural gas is *dry* if it consi hane and sold separately.

Natural gas res on dioxide, hydrogen sulfid ses. The natural gas is further pro tural gas suitable for sale. d transported in trucks or ships.

Natural Gas Indus

While this course fo financial markets can have a n gas market. The natural gas industry has three major segme

1. The upstream (supply). The *upstream* segment includes exploration and development of natural gas resources and reserves, production, which includes drilling and extraction at the wellhead, and gathering. Gathering entails using small-diameter pipeline systems to transport the gas from the wellhead to local pooling points or to natural gas processing facilities, where impurities and NGPLs are removed to create pipeline-quality natural gas.