



U.S. Energy Markets - Volume II: Wholesale Electricity

An Online Continuing Education Course for Engineers

Course Number: E-4078

Credit: 4 Hours / 4 PDH / 4 CPD

U.S. Energy Markets – Volume II: Wholesale Electricity

Lee Layton, P.E.

Table of Contents

Section Page

Introduction	3
Chapter 1, Electric Power Industry	5
Chapter 2, Electricity Demand	12
Chapter 3, Electricity Supply and Delivery	22
Chapter 4, Electricity Markets and Trading	36
Chapter 5, RTO/ISO Markets and Features	41
Chapter 6, Market Regions	51
Appendix A: Glossary of Terms	65
Summary	67

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 II of a five-volume series of courses about the U.S. wholesale electricity markets. This volume is comprised of six chapters. Chapter One provides a broad overview of the U.S. electric power industry. Chapter Two describes the demand for electricity, and Chapter Three explains the electric supply and delivery process in the U.S. Chapter Four discusses the wholesale electric trading markets. Chapter Five describes the RTO, ISO, and conventional utility markets in the U.S., and Chapter Six describes the differences in the market regions.

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

Electric Power Industry

Quick Facts: Measuring Electricity

Watt is a unit of power. It is the key measure of electricity and is the rate at which it is produced, transferred, or consumed. Similar measures are kilowatts (1,000 watts) and megawatts (1,000 kilowatts).

Watt-hours is the amount of electric energy generated or used over time. It is also referenced in kilowatt-hours and megawatt-hours.

The aggregation of units of power a generator, for example, is capable of producing is its *capacity*. The aggregation of power consumed at any location is the *demand* at that point.



Electricity is a physical product – the flow of electrons. It is a secondary energy source that is a result of the conversion of other energy forms, such as natural gas, coal, or uranium, or the energy inherent in wind, sunshine, or the flow of water in a river. Electricity is not visible or directly observable, but it can be turned on and off and measured.

Electricity markets have retail and wholesale components. Retail markets involve the sales of electricity to consumers; wholesale markets typically involve the sales of electricity among electric utilities and electricity traders before it is eventually sold to consumers. This course focuses on wholesale electricity markets, although it does address retail demand and other instances where retail markets strongly influence wholesale markets.

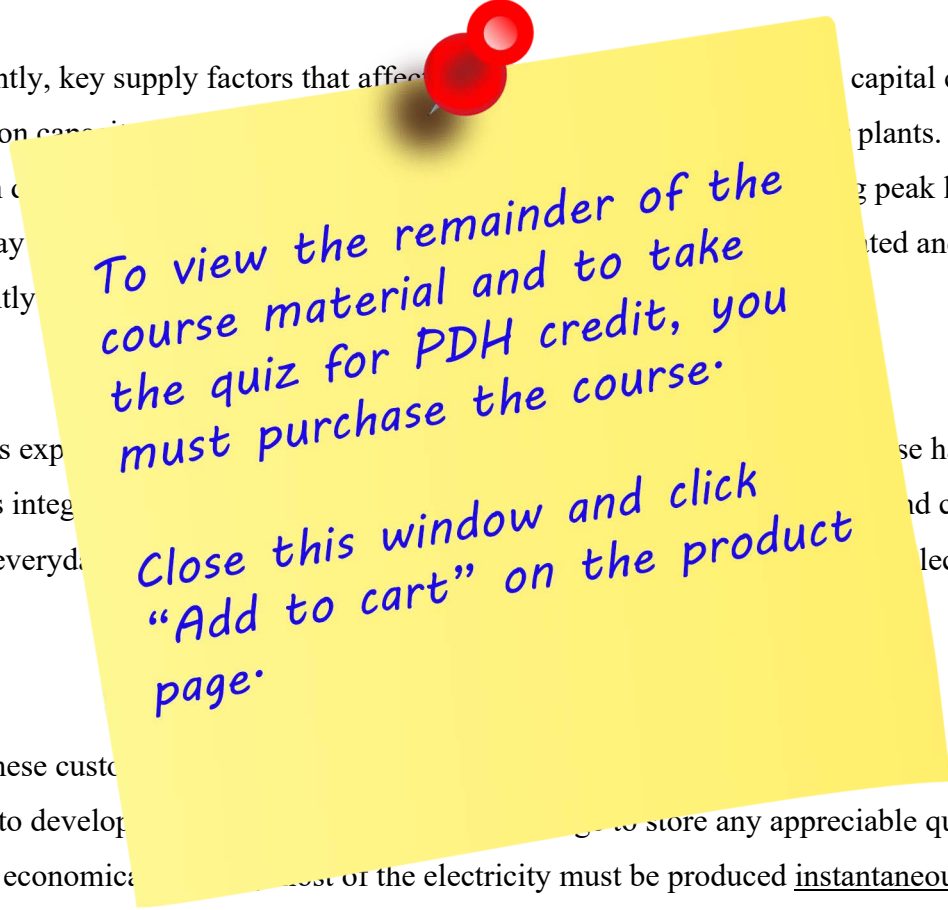
Much of the wholesale market and certain retail markets rely upon competitive market forces to set prices, while other prices are based on the service provider's cost of service. For wholesale markets, FERC either authorizes jurisdictional entities to sell at market-based rates or reviews and authorizes cost-based rates.

In competitive markets, prices reflect the factors driving supply and demand – the physical fundamentals. Where rates are set based on costs, market fundamentals matter as well because changes in supply and demand will affect consumers by influencing the cost and reliability of electricity. Supply incorporates generation and transmission, which must be adequate to meet all customers’ demands simultaneously, instantaneously, and reliably.

Consequently, key supply factors that affect capital costs, transmission capacity, and plants. Likewise, changes in demand, such as a peak load on a hot summer day, can lead to higher prices and consequently higher costs for consumers.

Consumers expect that electricity will continue to be used as it has grown as consumers integrate smart devices and computers into their everyday lives. The demand for electricity that they use.

Meeting these customer expectations is a challenge because the technology continues to develop rapidly. Unlike most other commodities, it is difficult to store any appreciable quantities of electricity economically. Most of the electricity must be produced instantaneously as needed. Further, unlike most other markets, electricity’s historical inelastic demand does not move with prices. To provide electricity on demand, electric system operations must be planned and conducted with that goal in mind. In the absence of storage and responsive demand, operators must plan and operate power plants and the transmission grid so that demand and supply exactly match every moment of the day, every day of the year, in every location.



To view the remainder of the course material and to take the quiz for PDH credit, you must purchase the course.

Close this window and click “Add to cart” on the product page.