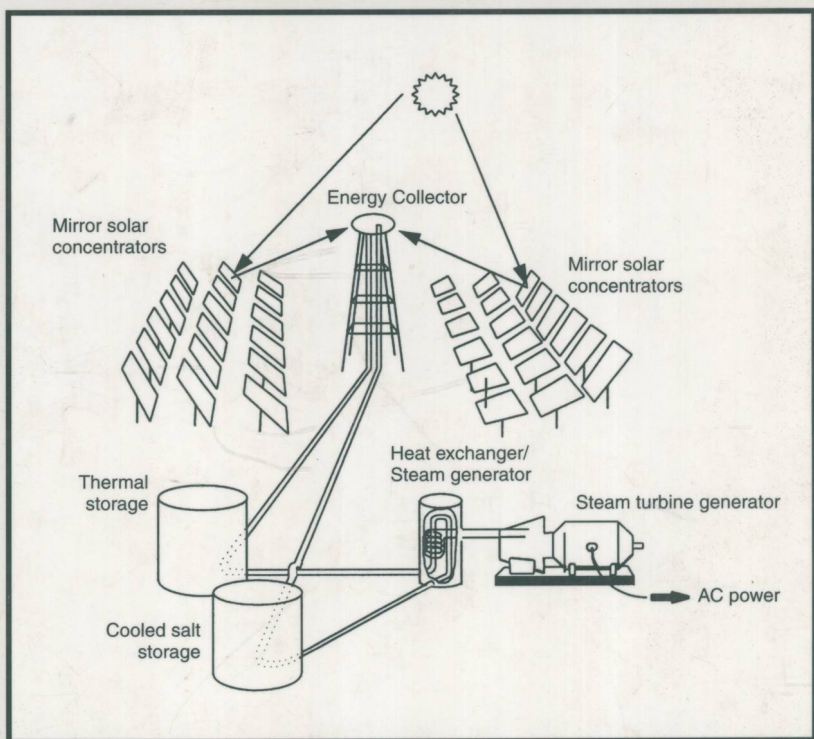


Understanding Electric Utilities and De-Regulation



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**Understanding
Electric Utilities and
De-Regulation**

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Series Editor

H. Lee Willis

*ABB Electric Systems Technology Institute
Raleigh, North Carolina*

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Series Introduction

Power engineering is the oldest and most traditional of the various areas within electrical engineering, yet no other facet of modern technology is currently undergoing a more dramatic revolution in both technology and business structure. A revolution of innovation and invention, including automation, custom power devices, intelligent appliances, operations optimization software, and more, is extending the capabilities of electric utility systems far beyond their traditional capabilities. But most important, the electric power industry is completely overhauling itself, as de-regulation and competition refashion every aspect of its organization, function, products and services, and even its very sense of identity. During these changes, thousands of people are joining the electric power industry for the first time, while thousands of its veterans find themselves grappling with new jobs, new terminology, and new ways of doing business.

Understanding Electric Utilities and De-Regulation was written with these people in mind. For the many who find themselves working in the electric industry for the first time, this book provides a simple, lay tutorial on electric power, along with an overview of the power industry, its history, its equipment and systems, its business structure and functions, and its future. In addition, for the long-time utility personnel who find it a challenge to fathom the complexities of the re-structured industry, this book provides as straightforward an explanation as possible about the why, what, and how behind de-regulation, a

review of the issues involved in making electric power work, both electrically and as a business, in a competitive market, and a comparison of how things worked in the past to how they will work in the future.

As both a co-author of this book and the editor of the Marcel Dekker Power Engineering Series, I am proud to include *Understanding Electric Utilities and De-Regulation* in this important series of books. The Series includes books covering the entire field of power engineering, in all its specialties and sub-genres, all aimed at providing a comprehensive reference library of the knowledge needed to meet the electric industry's challenges in the 21st century.

Like all the volumes in the series, this book focuses on providing modern power technology in a context of proven, practical application and is useful as a reference book as well as for self-study and classroom use. Unlike most, however, this book is non-technical, aimed at the non-engineer, as well as at those power engineers who need a quick, simple overview of de-regulation and how it impacts their role in the industry.

H. Lee Willis

Preface

Electric utilities all over the world are undergoing great change. In the United States particularly, a fundamental alteration of the electric power industry is occurring. The former vertically integrated electric utility, which performed all the functions involved in power – generation, transmission, distribution, and retail sales – is dividing, or “dis-aggregating” into separate companies devoted to each function. The ways in which electric utilities operate, and relate to their customers, are being completely overhauled.

This book examines how traditional utilities used to function; why and how their industry was “de-regulated” by governments worldwide; how they are restructuring themselves in response; and how they will conduct their business and compete in the future.

To those readers new to the electric industry, this book provides a simple and, as far as possible, non-technical tutorial on electric power, electric power systems and equipment, electric utilities, their customers, the history of the industry, and the basics of regulation, de-regulation, and competitive operation.

For long-time employees of the industry, this book, particularly its final five chapters, provides an overview of de-regulation: why it happened; the key aspects of change that must be addressed; the political, engineering, and business issues involved; the various

systems of de-regulation of electric operation – for there are several; and the resulting structure of the new competitive power industry.

We have tried to present the often complex business, regulatory, and engineering issues involved in a way readily intelligible to the lay person. We have also tried to avoid descending into a morass of minutiae pertaining to de-regulation. For example, the volumes of rules and regulations governing de-regulated electric industry operation in England and Wales fill much more than one bookcase, but the main ideas can be summarized in several pages, and contrasted to de-regulated operations in California, New York, or Argentina, using one table comparing key points.

Chapter 1 introduces the traditional regulated industry structure, describing the different types of electric utilities that have operated, and to an extent still operate, in the conventional manner. It then summarizes the process of de-regulation and the numerous different entities that have become major industry players since de-regulation.

In Chapter 2, the evolution of power systems' technology is charted from its beginnings, when electricity was a scientific curiosity in the 17th and 18th centuries, through the time of entrepreneurs like Edison and Westinghouse, who found practical uses for it, to the period of expansion of electrical power into rural and suburban areas, and finally to the present age of mergers, de-regulation, and downsizing.

Chapter 3 provides a basic tutorial on electricity and electric power, including how it is made, and how it is transported. It discusses basic concepts such as current, voltage, energy, and electrical losses during the transportation of power.

Chapter 4 looks at why, of all the sources of energy available to consumers, electricity is most often preferred. The answer is given in this chapter through comparisons with natural gas, coal, and nuclear power, and in descriptions of specific applications of power for light, heat, and mechanical motion. Ensuing discussions of daily appliance usage and power quality issues lead to the final topics – energy conservation, efficiency, and demand side management (DSM), an energy resource that may flourish in a competitive power market.

How energy is produced is the subject of Chapter 5, which explains the various types of traditional power generators used and how utilities operate them, along with some of the maintenance and economic constraints that fashion their use.

Chapter 6 looks at distributed and renewable generation – new technologies that could revolutionize the power industry in the next two decades. These

include generation from renewable power sources, such as low-head hydro, solar, solar thermal energy storage, photovoltaic cells, wind, trash-burning, biomass and geothermal. It also discusses modern distributed and dispersed generation such as micro-turbine generators and advanced fuel cells.

Chapter 7 concentrates on identifying and explaining the many different parts of a power delivery system (transmission and distribution system). It outlines the different levels and stages involved in transporting power and in delivering the specific amount needed to every electric consumer.

In emphasizing the different structures and *modus operandi* of the traditional regulated electric industry versus the de-regulated industry, Chapter 8 begins by examining the original need for, advantages of, and economics involved in the regulated, monopoly-franchise power industry. It then outlines why governments began to believe the benefits of de-regulation would outweigh the disadvantages, and discusses de-regulation and re-structuring, privatization, open-access and competition. Included are the four basic paradigms of electric utility structure, from total monopoly franchise to complete retail access. It concludes with a summary of the various new entities that will be created to handle the change from a vertically integrated to a vertically segmented, horizontally integrated industry.

Chapter 9 defines the roles of the various players in a competitive wholesale power generation market. Like shares of stock traded by brokers, different types of power, as well as a whole array of energy services, will be bought and sold. Scheduling the exchanges between buyers and sellers will create enormous engineering and accounting complexities, but hopefully offer great advantages in lower prices and innovative new ways of packaging and selling power.

Chapter 10 covers the interconnected power grid and its operation in a de-regulated system. Of necessity, this is a rather lengthy and, in places, quite intricate chapter, covering the multitude of different ways in which a de-regulated power grid can be set up to operate, and how each interacts with generators, transmission owners, system operators, and users of power. System operating measures, reserve capacity and its reservation, bases for pricing power delivery, definitions of ancillary services and their prices, firmness of commitment of resources, power congestion, and ways of pricing and managing it are among the many interrelated problems in the de-regulated power grid discussed here.

Chapter 11 looks at the distribution level of a de-regulated utility industry, clarifying the difference between transmission and distribution, and comparing the features and results of closed versus open-access distribution systems. It reviews new entities such as Discos and Rescos, and the changes in distribution

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1

The Electric Utility Industry

1.1 INTRODUCTION

Electricity is a very effective form of energy. It can be produced by a variety of methods, moved quite efficiently and safely, and fashioned into light, heat, power, or electronic activity with ease. Without it, neither the industrial nor the cultural levels achieved by the human race would be possible. Over eighty percent of the people on this planet have access to the personal use of electric power on a daily basis. It is provided to each of them by their local electric utility, the company or governmental department that produces and delivers electric power.

Electric utility is the traditional term for an investor-owned company or government-operated department that produces and sells electric power, and usually denotes a vertically integrated electric utility, one that performs all four of the functions involved in producing and selling electric power (Table 1.1). Strictly speaking, such “electric utilities” will not exist after de-regulation – parts of their traditional functions will be replaced by competitive companies, and the remainder will be greatly re-structured. But the functions they perform will endure, as will many companies that were regulated utilities for more than one hundred years, and then re-organized to adapt to the new industry order.

1

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1.1 INTRODUCTION

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Table 1.1 The Four Basic Electric Utility Functions

Function	Description
Generation	Power production, the actual manufacturing of electric power, by converting some other form of energy, be it coal, nuclear fission, fallen water, or sunlight, into electricity.
Transmission	Moving bulk quantities of electric power long distances, as from hydro-electric power plants deep in the mountains to large cities on the coast.
Distribution	Local delivery of power to consumers involves breaking up bulk quantities of power into “household” size amounts, and routing it to homes and businesses.
Retail Sales	Or more broadly, retail customer services. Measuring and billing consumers for the power delivered, and perhaps providing other services, such as energy efficiency or power quality automation.

De-Regulation

For over one hundred years, the electric power industry in nearly every country worldwide operated as a *regulated* industry – with electric utilities everywhere having a local monopoly – in any area there was only one company or government agency that produced, moved, distributed, and sold electric power and services. Often, this utility was state-owned. In other places it was an investor-owned, private company. Regardless, there was only one in any given area. Whoever wanted power had to buy it from the local utility.

Beginning in the 1980s, some nations began to experiment with changes in these rules for their electric industry. For a variety of reasons, it was felt that competition might be a better way to encourage investment in and operation of an electric industry. These experiments were by and large successful, and thus encouraged other nations to follow suit. Among the important concepts involved in de-regulation are:

Competition: Two or more entities vying for the same business or opportunity. In the power industry, competition is being created at two levels: wholesale (generation) and retail (distribution). In every case where a nation de-regulated its electric industry, its goal was to produce competition at the wholesale level, basically by allowing different