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OPERATION OF RESTRUCTURED POWER SYSTEMS

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List of Acronyms

ACE	Area Control Error
ATSOI	Association of Transmission System Operators in Ireland
BTM	Bilateral Transaction Matrix
Cal-ISO	California Independent System Operator
CEGB	Central Electricity Generating Board (UK)
CIL	Contracted Interruptible Load
DED	Dynamic Economic Dispatch
DISCO	Distribution Company
DSB	Demand Side Bidding (UK)
DVR	Dynamic Voltage Restorer
ELBAS	Nordpool Short-term Market
ELD	Economic Load Dispatch
ELSPOT	Nordpool Spot Market
EMC	Electromagnetic compatibility
EPACT	Energy Policy Act (US)
EPRI	Electric Power Research Institute (US)
ERPS	Enhanced Reactive Power Service (UK)
ETSO	European Transmission System Operators
EU	European Union
FERC	Federal Energy Regulating Authority (US)
GAMS	Generalized Algebraic Modeling Systems
GENCO	Generating Company
IEEE	Institute of Electrical and Electronics Engineers
IEC	International Electrotechnical Commission
IPP	Independent Power Producer
ISO	Independent System Operator

ITM	Interruptible Tariff Mechanism
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
LOLP	Loss of Load Probability
LRMC	Long-run Marginal Cost
LSE	Load Serving Entity (New York pool)
MC	Marginal Cost
NEMMCO	National Electricity Market Management Company (Australia)
NERC	North American Electric Reliability Council
NETA	New Electricity Trading Arrangements (UK)
NGC	National Grid Company (UK)
Nordel	A body for cooperation between ISOs of Nordic countries
Nordic	Norway, Sweden, Finland, Denmark and Iceland
NUG	Non-Utility Generator
NYISO	New York Independent System Operator (US)
NZEM	New Zealand Electricity Market
OFFER	Office of Electricity Regulation (UK)
OFGEM	Office of Gas and Electricity Markets (UK)
OPF	Optimal Power Flow
ORPS	Obligatory Reactive Power Service (UK)
PGCIL	Power Grid Corporation of India
PJM	Pennsylvania, Jersey, Maryland power pool (US)
PLF	Plant Load Factor
PPP	Pool Purchase Price
PSP	Pool Selling Price
PURPA	Power Utilities Regulating Policy Act (US)
REC	Regional Electricity Company (UK)
RTO	Regional Transmission Organizations (US)
SCED	Security Constrained Economic Dispatch
SMP	System Marginal Price
SPD	Spot Price Difference
SRMC	Short-run Marginal Cost
TRANSCO	Transmission Company
TSO	Transmission System Operator (Europe)
UC	Unit Commitment
UCTE	Union for Coordination of Transmission of Electricity (Europe)
UKTSOA	United Kingdom Transmission System Operators' Association
UPS	Uninterruptible Power Supply
WRATES	Wheeling Rate Evaluation Simulator

Preface

Deregulation is a fairly new paradigm in the electric power industry. And just as in the case of other industries where it has been introduced, the goal of deregulation is to enhance competition and bring consumers new choices and economic benefits. The process has, obviously, necessitated reformulation of established models of power system operation and control activities. Similarly, issues such as system reliability, control, security and power quality in this new environment have come in for scrutiny and debate.

In this book, we attempt to present a comprehensive overview of the deregulation process that has developed till now, focussing on the operation aspects. As of now, restructured electricity markets have been established in various degrees and forms in many countries. This book comes at a time when the deregulation process is poised to undergo further rapid advancements.

It is envisaged that the reader will benefit by way of an enhanced understanding of power system operations in the conventional vertically integrated environment vis-à-vis the deregulated environment. The book is aimed at a wide range of audience- electric utility personnel involved in scheduling, dispatch, grid operations and related activities, personnel involved in energy trading businesses and electricity markets, institutions involved in energy sector financing. Power engineers, energy economists, researchers in utilities and universities should find the treatment of mathematical models as well as emphasis on recent research work helpful. The book may be used for a one-semester graduate or under-graduate course, as well.

OUTLINE OF THE BOOK

Chapter-1 discusses the motivating factors behind deregulation of the power sector and the after-effects of the same. In this context it looks at issues specific to developed and developing nations.

Chapter-2 focuses on the established models of operational planning activities such as economic load dispatch, unit commitment and optimal power flow. Topics such as inter-utility power transactions, power pools, power wheeling and energy brokerage systems have been discussed. This chapter lays the foundation for the discussions in the subsequent chapters.

Chapter-3 analyzes different market models, and the operational planning issues specific to these, from the perspective of, both, the independent generator and the system operator. The requisite model development and reformulation demanded by a competitive environment is then discussed.

Chapter-4 identifies transmission management issues and then discusses the mechanisms by which these are addressed in the various forms of deregulated structures. The issues covered here are pricing, security and congestion management.

Chapter-5 focuses on ancillary service management, their categorization, and pricing mechanisms as practiced in different electricity markets. Reactive power management in deregulated markets has been examined in detail.

Chapter-6 on reliability and deregulation treats the basics of reliability analysis of power systems. Both system reliability and reliability experienced by the customer is discussed. The chapter also presents ways of characterizing the observed reliability of supply. The role of the office of electricity regulation (OFFER) in the UK system has been discussed.

Chapter-7 presents an overview of the various power quality issues. Emphasis is on issues strongly related to both the utility and the customer such as short interruptions, voltage dips and harmonics. For each of these phenomena an overview of available analysis techniques is given. The possible effect of deregulation on these aspects of power quality is discussed.

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