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Power Market Transformation

Reducing emissions and empowering consumers

Barrie Murray



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Power Market Transformation

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*To my dear grandchildren
Ella, Harris, Henry and Scarlett*

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Foreword

This book is written by an internationally renowned consultant with a lifetime's experience in the energy sector. The work is based on his most recent experience providing services across the world to investors, banks, government agencies and utilities engaged in restructuring the industry and implementing power markets. It draws on the authors previous experience operating as a senior manager with both a generation and transmission company as well as with a distribution company and equipment supplier. The analysis is illustrated with worked examples providing insight balancing fundamental methodology and academic theory with practical information. It follows the theme of two previous successful books published 10 years apart that track the developments in the sector. The work will be of value to those organisations engaged in managing the changes taking place in the sector and new entrants. It also provides tutorial material suitable for senior graduates and post graduates interested in a career in the industry. The author has a PhD based on related work, is a Fellow of the UK Institution of Engineering and Technology and a Fellow of the Chartered Management Institute.

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Preface

This book describes recent developments in the power and energy markets that are driving major changes in the generation mix, network requirements and customer engagement. The industry now faces new challenges associated with global warming and escalating demand from the developing countries such as China and India. The effect of government interventions to manage changes and to meet emission targets has resulted in an industry that is neither a free market nor centrally coordinated and lacks strategic direction. The uncertainty has resulted in a dearth of investment in generation and unprecedented low margins of spare capacity. This book provides an analysis of the changes and quantifies their impact. It reviews strategic decisions in the management of changes in the sector and aims to identify the optimal way forward to meet the triple objectives of security, affordability and sustainability with low emissions. It focuses on the economic aspects of initiatives to provide insight into their interaction. It will also provide insight into the opportunities in the sector to the many new potential players.

The book is based on the most recent developments in the energy sector and brings together all the initiatives that interact physically through the common network and financially through the energy market. It draws on extensive international experience in all sectors of the industry to bring clarity to the complex interactions. The book will be of value to all countries undergoing a transition. It will include worked examples and questions providing a basis for study and examination by academic institutions.

The sector is undergoing a major transformation to meet environmental targets and engage with a more active consumer base supported by smart networks and meters with local generation. The implications of these developments to the sector are not well understood. The development of distributed generation was forecast in my earlier 2009 publication to increase to meet 40% of the power energy needs by 2050 (p289). This book explains the implications of these developments to the existing market incumbents and a lot of new potential players. It also analyses the relative economics of central and distributed generation and associated network charges. It is presented in four parts.

Part 1 – How we arrived at where we are?

The first part of the book reviews the recent developments that are taking place in the international power sector across the world. It discusses the drivers of change and their impact on the market players and system operation. It discusses the impact of strategic decisions to accommodate renewable sources and their adverse affects on

the development and performance of the sector. It discusses the reaction of the industry and investors and the developing engagement with customers.

Part 2 – Review of low carbon generation technology options

The second part analyses the changing global landscape of the sector to meet the objectives of low emissions and cost whilst maintaining security. It analyses the economic and technical aspects of the use of: embedded small scale distributed generation; renewable generation sources; large and small scale nuclear and fusion; carbon capture and storage and biomass generation. Their potential to meet the evolving needs of the industry is analysed. The implications of developments to network requirements and charges are discussed.

Part 3 – How are the changes being managed within a market environment?

The third part discusses the market mechanisms in place and needed to manage the emerging developments. It discusses the balancing and capacity markets and the impact of renewable and embedded generation on conventional large scale generators. It reviews the impact on network utilisation and charging mechanisms. It appraises the potential for cross-border trading, demand side management and exploiting interaction with gas, heat and transport systems.

Part 4 – How do we get to where we want to be?

The fourth part focuses on the analysis of options to meet the three concurrent objectives of security, cost and sustainability in curtailing emissions to identify an optimum strategy. A set of scenarios is developed to provide a framework for analysis based on the use of an overview model coupled with a detailed model embracing the technical and operational aspects of system management. An approach to manage future trading and evaluate contract risks is outlined. It reviews smart grid developments and their potential to support the sector transition. The work concludes with a review of the governance and market arrangements to identify the need for any changes to meet the future requirements resulting from the impending transformation.

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