



# **MANAGING ENERGY RISK:**

a nontechnical guide to  
markets and trading

**BY  
JOHN  
WENGLER**

Copyright © 2001 by  
PennWell Publishing Company  
1421 South Sheridan/P.O. Box 1260  
Tulsa, Oklahoma 74101  
**1-800-752-9764**  
**sales@pennwell.com**  
**www.pennwell.com**  
**www.pennwell-store.com**

*Cover design and book layout by Joey Zielazinski*

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transcribed in any form or by any means, electronic or mechanical, including photocopying and recording, without the prior written permission of the publisher.

Printed in the United States of America

1 2 3 4 5 05 04 03 02 01

## **DEDICATION**

*To Dragana, my love*

# CONTENTS

|  |     |
|--|-----|
| <b>List of Figures and Tables</b> .....  | ix  |
| <b>Acknowledgements</b> .....  | xii |
| <b>Foreword</b>  |     |
| by Jeffrey Roark, Southern Energy .....  | xiv |
| <b>Editor's Note</b>   |     |
| by Dragana Pilipovic, SAVA .....   | xix |
| <br>   |     |
| 1. Introduction: The "Top Ten Checklist"<br>of Things to Do.....   | 1   |
| 2. The Bull, the Bear, and the Spark Spread .....  | 19  |
| 3. The Risk Management Policies and Procedures .....   | 47  |
| 4. Starting with Your Risk-Return Strategy .....   | 71  |
| 5. The Risk Roster: Personalities and Specialties .....  | 89  |
| 6. Energy Risk Boot Camp: "Must Know" Concepts<br>for Managers and Directors .....   | 103 |
| 7. The Deal Process: From the Desk to Delivery .....   | 145 |
| 8. The Portfolio Process: Starting with<br><i>What Have We Got?</i> and <i>What Do We Want?</i> .....  | 165 |
| 9. Measuring Risk: How Might<br>Our Portfolio Change?.....   | 203 |
| 10. Hedging: Navigating Toward<br>Our Portfolio Objectives.....  | 233 |
| 11. Critical Path IT Issues.....   | 255 |
| 12. Looking Forward: The Next Ten<br>Management Issues.....  | 267 |
| <br>   |     |
| <b>Appendix</b>  |     |
| <i>Items to Consider for Trading and Derivatives Policies,<br/>    Guidelines, Controls, and Internal Procedures</i> by Andrea S.<br>Kramer, McDermott, Will & Emery ..... | 281 |

**MANAGING ENERGY RISK: A NONTECHNICAL GUIDE  
TO MARKETS AND TRADING**

|                           |            |
|---------------------------|------------|
| <b>Glossary .....</b>     | <b>321</b> |
| <b>Bibliography .....</b> | <b>369</b> |
| <b>Index .....</b>        | <b>373</b> |

# FIGURES

|   |     |
|---|-----|
| Figure 1-1: Java Moments by Chapter.....                        | 16  |
| Figure 2-1: What Makes an Efficient Market?.....                | 24  |
| Figure 2-2: Dynamic Structure of a Market.....                  | 24  |
| Figure 3-1: The U.S. Constitution as Symbol of RMPP .....       | 49  |
| Figure 5-1: Concentric Circles Model .....                      | 95  |
| Figure 6-1: The Price-Risk Pyramid .....                        | 110 |
| Figure 6-2: Price-Mean Reverting Distribution .....             | 115 |
| Figure 6-3: Cinergy 5x16 Daily Forward Price Curve.....         | 115 |
| Figure 6-4: Entergy 5x16 Daily Forward Price Curve.....         | 116 |
| Figure 6-5: NYMEX Natural Gas<br>Daily Forward Price Curve..... | 116 |
| Figure 6-6: The Model Calibration Process .....                 | 120 |
| Figure 6-7: Volatility Term Structure .....                     | 123 |
| Figure 7-1: Overview of Deal Cycle .....                        | 147 |
| Figure 8-1: The Hedging Cycle .....                             | 167 |
| Figure 8-2: Simple Payoff Diagram.....                          | 170 |
| Figure 8-3: Delta on Payoff Diagram.....                        | 175 |
| Figure 8-4: Short Forward Position .....                        | 176 |
| Figure 8-5: Probabilities of Outcome .....                      | 177 |
| Figure 8-6: Long Call Option Payoff.....                        | 181 |
| Figure 8-7: Profit Diagram for Call .....                       | 182 |
| Figure 8-8: Parity Value of a Call Option .....                 | 183 |
| Figure 8-9: Four Mirror Images.....                             | 185 |
| Figure 8-10: A Long and Short Forward.....                      | 187 |
| Figure 8-11: Synthetic Call Option .....                        | 188 |
| Figure 8-12: Load Curtailment Contract.....                     | 189 |
| Figure 8-13: Two Long Call Options .....                        | 190 |
| Figure 8-14: Generator's Initial Portfolio .....                | 191 |
| Figure 8-15: A Dream Profit Diagram.....                        | 199 |
| Figure 8-16: Profit Diagram by Risk Return Strategies.....      | 200 |
| Figure 9-1: Different Risk Measures .....                       | 212 |
| Figure 9-2: Sample Risk Profiles.....                           | 214 |
| Figure 9-3: Sample Delta Values.....                            | 216 |

**MANAGING ENERGY RISK: A NONTECHNICAL GUIDE  
TO MARKETS AND TRADING**

|  |     |
|--|-----|
| Figure 9-4: Delta by Underlying Price.....                 | 218 |
| Figure 9-5: Portfolio Risks by Time Bucket.....            | 223 |
| Figure 9-6: Progressive Risk Limits.....                   | 229 |
| Figure 10-1: Strategy Defines Hedging.....                 | 235 |
| Figure 10-2: Comparing Initial & Objective Portfolios..... | 236 |
| Figure 10-3: Achieving the Desired Portfolio.....          | 237 |
| Figure 10-4: Generator's Initial Portfolio.....            | 248 |
| Figure 10-5: The "Temporary" Portfolio.....                | 250 |
| Figure 10-6: The Hedged Portfolio.....                     | 251 |
| Figure 10-7: The "Collar" Portfolio.....                   | 252 |
| Figure 10-8: Collar Hedging Strategy.....                  | 252 |
| Figure 10-9: Residual Risk.....                            | 253 |
| Figure 11-1: Trading and Portfolio Management System.....  | 257 |
| Figure 11-2: Perceptual Map for System Selection.....      | 264 |

# TABLES

|            |  |     |
|------------|--|-----|
| Table 1-1  | The "Top Ten Checklist" of Things<br>for the New Manager to Do ..... | 4   |
| Table 1-2  | The Manager's Bookshelf .....  | 11  |
| Table 2-1  | What Makes an Efficient Market? .....                                | 22  |
| Table 2-2  | Applications of Marking-to-Market<br>(MTM) Concept .....             | 38  |
| Table 3-1  | Differences Between Policies and Procedures.....                     | 60  |
| Table 3-2  | Sample Outline for Risk Management Policies .....                    | 62  |
| Table 3-3  | Sample Outline for Risk<br>Management Procedures.....                | 63  |
| Table 3-4  | The Five Questions for Portfolio Analysis .....                      | 66  |
| Table 4-1  | The Four Risk-Return Strategies .....                                | 73  |
| Table 4-2  | Headline Stories Due to Strategic Conflicts.....                     | 85  |
| Table 6-1  | Summary of the Five-Minute<br>Energy Risk Manager.....               | 106 |
| Table 6-2  | Parlance for an Option's Value.....                                  | 131 |
| Table 6-3  | Survey of Energy Options .....                                       | 134 |
| Table 6-4  | Traditional Price Risk Greeks .....                                  | 137 |
| Table 7-1  | Comparison of Settlements by Market .....                            | 159 |
| Table 7-2  | Sample Expiration Date Rules.....                                    | 159 |
| Table 7-3  | Delivery Settlement Rules .....                                      | 161 |
| Table 7-4  | Payment Rules.....   | 162 |
| Table 8-1  | Comparison of Risk Management Definitions .....                      | 166 |
| Table 8-2  | Basic Option Positions<br>in Traditional Utility Terms .....         | 184 |
| Table 9-1  | Litany of Risks .....  | 204 |
| Table 9-2  | Portfolio Sensitivity to Price Spikes .....                          | 221 |
| Table 9-3  | Sample Time Bucket Format.....                                       | 222 |
| Table 9-4  | Volumetric Risk Measures .....                                       | 225 |
| Table 9-5  | Steps for Setting Risk Limits .....                                  | 226 |
| Table 9-6  | Enforcement Techniques .....   | 227 |
| Table 10-1 | Hedging Technique by Risk Type.....                                  | 245 |
| Table 12-1 | Next Year's "Top Ten Checklist"<br>of Issues to Worry About .....    | 268 |

## ACKNOWLEDGEMENTS

Most authors save the most important acknowledgement for the end. But I want to start with a huge THANK YOU to Dragana Pilipovic, my lovely wife. Without her this book would not have been possible.

I next must thank Jeffrey Roark of Southern Energy for his glorious wit and experience. Jeff's comments could have been a book unto themselves and I feel very lucky to have benefited from his contributions.

Thanks to Bob Smock, Vice President, Group Publishing, and Director of the Global Energy Group, for PennWell, for suggesting the idea for this book several years ago and then harvesting the concept in 1999; Kirk Bjornsgaard, my PennWell editor, for his support and motivational emails; John Sodergreen of Scudder Publications and *The Desk* newsletter for his humor; SAVA Risk Management Corporation for allowing me the time to write the manuscript; and my friends and colleagues who provided the wonderful guest essays and interviews that appear within the chapters: Jim Clarke, Dunham Cobb, Ted Coates, Jeff Deneau, Adrian D'Silva, Tom Hahn, Glen Justis, Kevin Kremke, Greg LaFlame, Bob Smock, Karl Stanley, and Don Winslow. A special thanks goes to Andrea Kramer, a partner at McDermott, Will & Emery, for her contribution, both of a guest essay as well as the incredible outline of *Risk Management Policies and Procedures* provided in the Appendix.

I also want to express my appreciation to Professor John Bilsor and Ken Gibson of the Street School of Business, Illinois Institute of Technology, for giving me the climate to develop many ideas as an instructor.

Thanks to the people who responded to a questionnaire that I used to help write the final chapter on future issues: Barry Campbell, Energy Market Planning Manager, Nebraska Public Power District; Christophe Chassard, Global Head Structuring and Risk Management, RWE Energy Trading Limited; Chris Cramer, Risk Analyst, Duke Energy International; Jeff Deneau, Market Risk Analyst, NiSource Inc.; Samir F. Elia, Director, Risk Management, PG&E Energy Trading; Rob Gunnin, VP Risk Management, ICF Consulting; Jay Lindgren, Senior Quantitative

## ACKNOWLEDGEMENTS

Analyst, R. W. Beck; Cliff McPherson, Lead Auditor, Northeast Utilities; David E. Mousseau, President, Strategic Energy Management Corp.; and Todd McRae, Market Analyst, TransAlta Energy Marketing.

I apologize in advance for any errors, omissions, or hyperboles that take away from my goal of advancing risk management in energy markets. All mistakes are mine alone and I would appreciate reader feedback.

I want to thank my great kids, Nevena and Sasha, for giving me space when I wanted it and diversions (especially soccer—Go Trevians!) when I needed it. Thanks to my parents Roman and Joan Wengler for the continued support. Finally, thank you to Dragana for being my love and my muse.

John Wengler  
jwengler@rwbeck.com  
or  
authors@pennwell.com  
www.pennwell-store.com  
March, 2001  
Winnetka, Illinois

## **FOREWORD**

**Jeffrey Roark,  
Principal, Regulatory Affairs  
Southern Energy**

As a graduate student in electrical engineering at Auburn University in the mid-1970s, I sometimes led tour groups through our AC Lab, a dusty hall filled with electrical machinery collected over 80 years. The old machines, meters, and switchgear gave the appearance of an electric power museum, if not a 1950s horror movie. During one such tour, a prospective engineering parent asked me, "Why would you want to study power? Power never changes." Standing among the museum pieces, some still in use, I felt powerless to object, even though the term "Energy Crisis" had already entered the street vernacular several years earlier.

Twenty-five years of power industry experience later, I finally found the answer that I had needed on that day. The laws of physics never change. (We hope that this is true, even if what we know and say about the laws of physics changes rather often at the edges.) The Law of Conservation of Energy is immutable. (The Law of Conservation of Energy is the energy equivalent of "There is no such thing as a free lunch.") But as with any human economic endeavor, the power industry never stops changing. And as with the entire world economy and political structure, the pace of change in the power industry has accelerated to a dizzying deregulating open market whirl today. May it never end!

In 1995, I was one of the first three full-time inhabitants of Southern Energy's new Trading Center: a small corner office that only weeks before had housed a single occupant. As a 20-year veteran of tremendous change in the power industry, I found myself in yet another whole new world. My 1980s vintage MBA, though helpful, seemed like ancient history. I was in Risk Management 101 without a professor, a classroom, or even a book. Our one and only trader, Sean Murphy, had traded mortgages before, and he realized—electricity is different. We needed help! By chance, Sean found the names of Dragana Pilipovic and John

Wengler, of SAVA Risk Management Corporation, and invited them to come to Atlanta to talk with us about energy trading and help us explore the aspects of electricity that make it unique among commodities. A short few weeks later, they arrived in Atlanta. It was a pivotal moment for us all. John and Dragana, with knowledge and experience in oil and gas trading and risk management, were eager to learn about electricity. We were equally eager for them to learn about electricity and to help us out. Not only did I find in them a pair of professors for my rolling Risk Management 101, but I discovered that these were two delightfully intelligent and energetic people, and I have valued their friendship ever since.

Much has progressed since our first meeting. Southern Energy's Trading Center has grown to be the world's largest energy trading center, employing hundreds of employees, many of whom had not yet seen their twentieth year of life (much less of the power industry) when our "Corner Office" Trading Center first opened. In 1998, Dragana Pilipovic "wrote the book" on the subject—namely *Energy Risk*—with John's help of course. Energy risk management itself has become very hot news. After price spikes in eastern markets in 1998 and 1999 caused some notable bankruptcies, defaults, and early exits from electricity trading, the western price spikes in the summer of 2000 have even politicians demanding more forward hedging on the part of the local electric utilities. It seems that as an industry, and especially those living on the volatile margin, we learn through pain. (I am referring to both buyers and sellers of electric energy at the wholesale margin, as opposed to integrated utilities with rather stable average costs even in the face of wholesale price spikes.)

What better timing could there be for John's book on energy risk management aimed not at the quantitative whiz kids, but at managers of electric utilities? Regional transmission organization (RTO) formation is on the horizon. Every step toward competition adds risk to the energy supplier's business. California in 2000 has shown that we still have plenty to learn about risk management. And if today's popular backlash against competition in electricity is successful, it will have occurred because of a failure to grasp and embrace risk management principles.

The entire deregulation of the industry is an exercise in exposing risks that were hidden by regulation, and allocating, through markets,

## MANAGING ENERGY RISK: A NONTECHNICAL GUIDE TO MARKETS AND TRADING

the various risks to those best able to manage them. Competitive energy suppliers risk billions of dollars on physical generating assets, and manage those risks through geographic diversity, fuel diversity, efficient plant operation, and trading and marketing of energy products. Transmission owners will manage the physical availability of their assets to maximize their profits. Users of the grid will find usage prices to be volatile, much like energy prices, and will manage their transmission price risk through tradable contracts, whether these are physical or financial. It is important that any company operating in this environment learn to analyze its risks and manage them appropriately. And, it is important that risk managers understand and internalize the concepts behind risk management in the electricity industry, rather than just learning the right things to do. Learning this stuff by rote is an instant recipe for learning through pain, because that which is right today will change tomorrow. We don't really know what will happen next. (This is much more fun than, "Power never changes.")

Complexity is not escapable in the electric utility industry. Efforts to ignore it fail. The Pennsylvania-Jersey-Maryland (PJM) independent system operator (ISO) tried to ignore it, and failed. New England tried to ignore it, and failed. California tried to overpower it with a "simplified" system, and failed. New York tried to embrace complexity, and found more devils in the details. But it always makes me smile when I see another one hit the dust. Folks, the complexity in power generation and delivery is real. It cannot be forced to look like or behave like gas or oil. And without regulation to cram all of the risks onto consumers, these complexities will continue to dog market participants until they deal with them explicitly. Unfortunately, we will likely find that consumers do not want to deal with the complexities or the volatility inherent in electric service.

This, I believe, forms the challenge for risk managers in our industry—to deal with and absorb the physical complexities and the concomitant financial complexities associated with electric service, providing price stability, efficiency, reliability, and simplicity to electric consumers. Given the unavoidable complexities, this is a tall order. The work has barely begun. Many practicing traders, marketers, and risk managers in electricity don't even understand their jobs yet. And though many are new

to the industry, they are already actively resisting change from what they already know how to do. They want to settle in and do trading and make money; unfortunately, the final rules of the game are hardly in place.

This book, *Managing Energy Risk*, offers a valuable tool in meeting this challenge dealing with market realities. This book helps demonstrate how risk management *theory*, not just practice, can become second nature to those of us in this industry. These kinds of risk management ideas will help us absorb and control the many changes that lie ahead. Complexity in electricity risk management will increase. (In time, simplicity will return to consumers if they demand it.) But this time, if we listen closely to the market and respond wisely, we can make "good" with our new market opportunities, with its full complexity contained once more in an envelope of market-developed risk management tools and techniques properly designed around the physical realities.

This book is an introduction to energy risk management aimed at utility engineers and managers. For those engineers with an MBA or other quantitative business background, this book will help direct some of that educational experience toward a new way of thinking about the energy business. For those engineers, and especially managers, without a quantitative business background, I hope it encourages them to find an MBA program and place it firmly into their background. Of course, there will always be jobs in the utility industry in a quiet, sheltered environment with a relaxed pace of change and little exposure to risk. Unfortunately these are likely to be low paying, uninteresting jobs of lesser value. This book is for those who want to embrace the change and accept risk and risk management as means to a more exciting and better paying future in the electric utility industry. In fact, for many this will come of necessity, because the electric utility industry of the future will look very different from that of today.

Like the old AC lab at my alma mater, the electricity industry continuously collects new ideas to join the old ones. The secret to our success in dealing with new market challenges is how well we integrate new market-oriented ideas with our traditional engineering duties in generating power. Just as understanding physics is important for being an engineer, understanding risk management is increasingly important for being a

## MANAGING ENERGY RISK: A NONTECHNICAL GUIDE TO MARKETS AND TRADING

manager of an energy business in the future. But the engineer with an MBA has an advantage—understanding of both physics and risk management. Though people have a natural preference for simplicity, the physical complexities of the electricity business have reasserted themselves time and again. Good engineers and good managers alike are needed to make sense out of the risks that are driven by the fundamentals, the ones that don't fit well into quantitative analysis. There yawns a gap that needs bridging, and in this industry it is uniquely important. Engineers can and do build bridges. In this book, may you sight your landing on the other side.

Jeffrey Roark  
Jeffrey.Roark@southernenergy.com  
Atlanta, GA  
December 2000

*Jeffrey D. Roark, a 29-year student of the electricity industry, is Principal, Regulatory Affairs, for Southern Energy, Inc., in Atlanta, GA. He holds Bachelor's and Master's degrees in Electrical Engineering at Auburn University, and an MBA from the University of Alabama at Birmingham. His experience in the industry includes transmission and generation planning in Southern Company's regulated business, as well as seven very interesting years of market analysis work in Southern Energy's trading, marketing, and asset development business in the United States and abroad.*

# EDITOR'S NOTE

by Dragana Pilipovic, SAVA

When John started writing this book, we agreed that the market needed a nontechnical guidebook for managers dealing with trading and risk management. Why not another technical book? Simple—the math scares off the average manager and prevents him/her from understanding risk and other issues. We were still left figuring out how to transfer our belief in the power of risk-related ideas. I felt a bit like Dr. Frankenfurter in the movie "Rocky Horror Picture Show" when he declared "I'll remove the cause, but not the symptom!"

At a coffee shop in our hometown, John and I ultimately landed on the notion of the *Risk Management Policies and Procedures* (RMPP) as providing the natural framework for this book. If it belonged in the RMPP or helped the manager understand the RMPP, then we should explore the topic. If a subject strayed too far afield, or did not have the simple benefit of being entertaining, that subject fell to the cutting room floor.

We had expected to use the "nontechnical" standard a lot more than we wound up doing. By keeping the focus on the manager's needs—in other words, using a mark-to-manager process— John typically found words and analogies to do the talking rather than relying on equations. That's the way it should be. The math can be left to the quantitative analysts working for the manager.

(A quick word for those quantitative analysts who are reading this book. For those of you working wonders in support of the trading desk, this is a great book if one day you want to be *in charge* of that trading desk. It's also a good book for understanding the reasons why quantitative analysis is important and how to make it better serve the industry.)

In editing this book, I looked for the right balance between the "big picture" and the kinds of detail that are absolutely necessary for true under-

## **MANAGING ENERGY RISK: A NONTECHNICAL GUIDE TO MARKETS AND TRADING**

standing. This book may be nontechnical, but the subject material remains very complex. It is my hope—and John’s as well—that this book finds a comfortable spot among the great books on energy risk management.

Dragana Pilipovic  
drag@sava.com  
Winnetka, Illinois  
December 2000

*Dragana Pilipovic founded SAVA Risk Management Corporation in 1993 to provide analytic and risk solutions for the electricity and energy markets. In 1998 she published her groundbreaking book Energy Risk: Valuing and Managing Energy Derivatives (McGraw-Hill.) She lives in Winnetka, Illinois with John and their two children.*