

NANYANG TECHNOLOGICAL UNIVERSITY
Nanyang Business School
Financial Engineering Program
FE8825 Energy Derivatives
Advanced Topic in Financial Engineering Studies Mini Term 5 — 2010
Dr. Ehud I. Ronn

Textbook: Options, Futures, and Other Derivatives, John C. Hull, Prentice Hall, 2009.
The textbook serves as supplementary material; the course does not “follow” the book.
Rather, the predominant material in this course is presented in the Lecture Packet.

Case Studies:

FE8825 Energy Derivatives is designed to provide students with a fundamental understanding of energy markets and their relevant analytics. We will consider three case studies:

1. Valuation of Power Plants
2. MW Petroleum Case (risk sharing; valuation of average-style options)
3. Oil Fields as an Extraction Option

Course Outline:

The objectives of this course are to introduce students to the manner by which energy corporations manage their business risk exposures, and the derivative securities which can be utilized for this purpose:

1. Overview of energy markets
2. Principles of risk management: Objectives and tools
3. Measurement of corporate risk, including Value-at-Risk
4. Proper role of derivatives in firms' risk management
5. Understanding the valuation and role of futures contracts and swap agreements
6. Brief review of the principles of option and derivative-claim valuation, hedging and uses; numerical procedures involved in derivative valuation
7. Understanding the structuring, reverse engineering and valuation of OTC derivatives
8. Understanding the uniqueness of commodity derivatives (relative to financials)

Session Contents

- 1 (a) The Equity, Credit and Commodity Markets — A Spring 2010 Update
(b) Historical Development of Risk Management Tools
- 2 (a) Review of Forwards and Futures Contracts
(b) Commodity Swaps
(c) Forward Prices \neq Expected Spot Prices (aka “The Market Price of Risk”)
 - In Financial and Energy Markets
 - Implications for Energy Markets

- 3 (a) Risk-Management from a Corporate Perspective:
 - Hedging a Short or Long Position with Futures or Options
 - Implementing a Corporate-Level Risk-Management Policy(b) Review of Basic Option Properties
- 4 (a) Estimating the Price Process in Energy Markets
 - Historical Volatility; The Term Structure of Volatility (TSOV)
 - Estimating Volatility from Market Prices of Options in Energy Markets
 - Historical or Implied Vols?
 - Characterizing the Volatility “Surface” Across Time and Strike(b) Valuation of “Real Options”:
 - Applying options theory to valuation of power plants
 - Valuation of oil fields as optimal exercise of extraction option
- 5 Energy Derivative Products: The Role of Structuring, Calibration, Valuation and Hedging in Profitable Market-Making
- 6 (a) Extrapolating in Energy Markets
(b) VAR (Value-at-Risk) in the Energy Industry