

METU INSTITUTE OF APPLIED MATHEMATICS

Course Title:	Special Topics: Stochastic Energy Pricing Models
Course Code:	IAM 753
Credit:	3(3-0)
Instructor's Name:	Martin Rainer
Prerequisites:	Stochastic Calculus (e.g. like textbook of Lamberton-Lapeyre); and consent of the instructor;
Content:	<p>Motivation:</p> <p>Energy markets and related pricing models for the major traded assets and financial instruments becomes increasingly important for Turkey, due to several forthcoming projects in the energy markets which make Turkey a main distribution hub between the Middle East and Europe.</p> <p>This course concentrates on mathematical concise models for the pricing of assets and derivatives in the related markets of gas, electricity, and temperature. The framework is that of general Levy processes, related Ornstein-Uhlenbeck processes and semimartingales, including jumps and stochastic volatility.</p>
Aims:	After this course the participant will have a detailed understanding of major mathematical models for energy markets, their application to the gas, electricity, and temperature markets and their derivatives. The assumptions, advantages and drawbacks of alternative models are clarified. In parallel to the theory, hands-on examples will be elaborated by the participants using MATHLAB and Excel.
Learning Outcomes:	At the end of this course, students should know how to price assets and derivatives in the major energy markets. The critical judgment towards alternative modeling approaches will be sharpened. The student will also learn how to structure complex tasks, such as the construction of electricity forward curves. Mathematical knowledge and methodology of general semi-martingales and Levy processes will be deepened and trained. This course is an important step for participants who wish to do their MSc or PhD thesis in energy market models, and/or wish to prepare to work as quantitative analyst for a trading desk in energy markets.
Suggested Textbooks:	<p>Lecture notes will be prepared during the course.</p> <p>Most of the content of this course is covered in:</p> <ul style="list-style-type: none"> • F. Benth, J.S. Benth, S. Koekebakker, Stochastic Modelling of Electricity and Related Markets, 2008

	<ul style="list-style-type: none"> • L. Clewlow, C. Strickland, Energy Derivatives: Pricing and Risk Management, 2000 • A. Eydeland, K. Wolyniec, Energy and Power Risk Management, 2003 <p>Further special references will be given during the course.</p>
Outline:	<ul style="list-style-type: none"> • Energy markets survey (1 week) • Energy spot price models (1 week) • Forward and swap pricing (1 week) • Gas spot and future modeling (1 week) • HJM modeling approach to forwards and swaps (1 week) • Construction of electricity forward curves (1 week) • Electricity future model (1 week) • Principal component analysis (1 week) • Model calibration (1 week) • Options on forwards and swaps (1 week) • Asian and spread options (1 week) • Temperature modeling (1 week) • Temperature derivatives (1 week)
Resources:	<ul style="list-style-type: none"> • LaTeX • MATLAB, Excel