

Course Syllabus – DRAFT

ISEN 450: Fundamentals of Energy Trading and Risk Management
(0.5 credit, Fall, Elective)
Northwestern University

Course Synopsis:

This course provides a broad overview of the nature of physical and paper trading energy markets (with a particular focus on energy) and the various strategies that can be employed by firms and investors in them. The course touches on issues relating to risk management and discusses the use of derivatives to combat risk in resource markets. Additionally, it will explore broad topics in the field of commodity futures such as backwardation and contango.

Course Goals:

The course is primarily focused on the following goals:

- **Understanding Determinants of Demand and Supply:** A key objective of this course is understanding the causal factors of price/quantity fluctuations in energy markets.
- **Understanding Derivatives and Derivatives Pricing:** Students must understand the formation and pricing of derivatives from two angles: specific to energy and general to commodity markets.
- **Risk Management Techniques in Volatile Markets:** Students must learn techniques of risk management as they broadly apply to markets and specifically to energy commodity markets. This is also an extremely applicable personal skill to have.
- **Understanding the Difference Between Paper and Physical Trading:** Students will approach all the topics in the course with a clear notion of what forms of energy trading they pertain to. This difference will be crucial for students to understand going forward.

Grading/Assessment:

Grading will be based on the following rubric:

Component	Weight	Details	Due
Effort and Attendance	20%	Attendance and active participation is required for all classes given that it is a 5 week program	-
Case Studies	30%	Written, individual submissions. Case study assignments constitute the bulk of the grading for this class and are the primary mode of assessment. Students will be given cases and certain questions pertaining to them, which they will be expected to answer in detail. Submissions that engage with both the specifics of the situation and the broader themes of the class will be rewarded with higher grades.	Week #2 Week #3 Week #4
Simulation	20%	The students will participate in an exercise using a market simulation tool. Grading will be based on learning from the exercise rather than performance in the simulation	
Final Research Presentation	30%	Students will work in pairs for this presentation. Pairs must identify one key trend in the energy markets of today, and attempt to predict its impact on the demand and supply for a particular energy commodity. Their presentation must include an explanation of the cause of the trend, a justified prediction of the trend's impact and an investment recommendation based on detailed analysis of the trend/fundamental analysis of the commodity. Students must have the trend they will analyze for the presentation selected by the end of Week 4, where it must be approved by the instructor.	Week #5

Grading Policy:

- Grades will be assigned based on all the work you have completed during the semester following the traditional practice of A=90-100, B=80-89, C=70-79, D=60-69, F<60.

Course Readings:

M. Denton, A. Palmer, R. Masiello and P. Skantze, "Managing market risk in energy," in IEEE Transactions on Power Systems, vol. 18, no. 2, pp. 494-502, May 2003.

Deng, S, and S Oren. "Electricity Derivatives and Risk Management." *Energy*, vol. 31, no. 6-7, 2006, pp. 940-953., doi:10.1016/j.energy.2005.02.015.

Mulhall, Rachel Ann, and John R. Bryson. "Energy Price Risk and the Sustainability of Demand Side Supply Chains." *Applied Energy*, vol. 123, 2014, pp. 327–334., doi:10.1016/j.apenergy.2014.01.018.

Fan, Zhenyu, et al. "What Smart Grid Means to an ISO/RTO?" *Ieee Pes T&d 2010*, 2010, doi:10.1109/tdc.2010.5484362.

Brunet, Alexia, et al. "Beyond Enron: Regulation in Energy Derivatives Trading."

Fleming, Jeff, and Barbara Ostdiek. "The Impact of Energy Derivatives on the Crude Oil Market." *Energy Economics*, vol. 21, no. 2, 1999, pp. 135–167., doi:10.1016/s0140-9883(99)00003-1.

A. Roark, P. Skantze and R. Masiello, "Exploring Risk-Based Approaches for ISO/RTO Asset Managers," in Proceedings of the IEEE, vol. 93, no. 11, pp. 2036-2048, Nov. 2005.

Tunsgj, Øystein. "Hedging Against Oil Dependency: New Perspectives on China’s Energy Security Policy." *International Relations*, vol. 24, no. 1, Mar. 2010, pp. 25–45, doi:[10.1177/0047117809340543](https://doi.org/10.1177/0047117809340543).

Cotter, John, and Jim Hanly. "A Utility Based Approach to Energy Hedging." *Energy Economics*, vol. 34, no. 3, 2012, pp. 817–827., doi:10.1016/j.eneco.2011.07.009.

Kerste, Marco, et al. "Systemic Risk in the Energy Sector—Is There Need for Financial Regulation?" *Energy Policy*, vol. 78, 2015, pp. 22–30., doi:10.1016/j.enpol.2014.12.018.

Ciner, Cetin. "Hedging or Speculation in Derivative Markets: the Case of Energy Futures Contracts." *Applied Financial Economics Letters*, vol. 2, no. 3, 2006, pp. 189–192., doi:10.1080/17446540500461729.

Other articles from the journal *Energy Policy* may be of value here.

CLASS OUTLINE

Weekly Topic	Description
<p>1: Introduction: Determinants of Demand/Supply and Nature of Energy + Electricity Markets</p>	<ul style="list-style-type: none"> ● Introduction and course logistics. ● Basic understanding of the difference between paper trading (derivatives) and physical trading (the commodity itself). Understanding which of these categories will be dealt with in the course. ● Determinants of demand and supply in energy markets: global commodity pricing, weather, economic activity, cost to carry, financing cost, OPEC intervention etc. <p>CASE STUDY #1</p>



<p>2: Energy Commodity and Derivatives Trading</p>	<ul style="list-style-type: none"> ● Basic understanding of investing in the energy commodity market. Different methods of investing in energy commodities: futures, options, ETFs, mutual funds, index funds etc. ● Understanding energy derivatives as a means to reduce commodity price risk. ● Understanding basis risk: calendar basis risk and locational basis risk. ● Hedging against commodity price risk: energy futures, swaps and options as methods of risk management. ● Use of energy derivatives to offset risk associated with doing business: how do big oil and gas companies like Chevron, BP, Shell use derivatives? <p>CASE STUDY #2</p>
<p>3: Energy Commodity and Derivatives Trading (Continued)</p>	<ul style="list-style-type: none"> ● Understanding the forward curve, contango and backwardation. What is the relationship between the nature of the forward curve/ future contract and arbitrage opportunities? ● Storable vs non-storable commodity derivatives: how do they differ? Do the risk management strategies from this course apply in the same manner for both? ● How are derivatives priced? Overview of common pricing methods for futures, options and swaps such as Black-Scholes for options, interest rates for swaps. Particular focus on mark-to-market (fair value) accounting of an asset as a tool for price determination of futures. <p>CASE STUDY #3</p>
<p>4: Miscellaneous Topics: Trading Indexes, Physical Trading, Comparisons</p>	<ul style="list-style-type: none"> ● Trading indexes for energy commodities: indexes such as NYMEX for crude oil, Brent crude and refined products such as kerosene and heating oil. ● Physical Trading: market organization in electricity markets, ISOs (Independent System Operators) and RTOs (Regional Transmission Operators), basic refresher of core concepts related to the grid. ● Locational Marginal Pricing in electricity markets: three components of LMP, the energy cost, the congestion cost and the losses. Locational differences in pricing. ● Comparisons with water/food/gas trading in terms of market structure and key derivatives. <p>Students must have finalized the trend they will be focusing on for their final presentation with their instructor by the end of Week #4.</p> <p>SIMULATION TOOL EXERCISE</p>



5: FINAL PRESENTATION WEEK	<ul style="list-style-type: none">• Students will present their final presentations and will hand in their executive summaries to the instructor.