

## Course Syllabus

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

Instructor: Chet White ([chester.white@northwestern.edu](mailto:chester.white@northwestern.edu))

**Office Hours:** By appointment

**Classroom:** Tech L251

**Class Timing:** Thursdays 6-8:50pm; Oct. 28-Dec 4, 2021; Finals Week Dec 6-11, 2021

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### **Course Synopsis:**

This course provides a broad overview of the nature of physical and paper trading 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. Students will be assigned 2-3 readings/cases each week. The students are expected to come prepared to discuss the cases during Thursday classes. Certain questions pertaining to them will be assigned and students, are expected to answer in detail and return to the professor by the due date. Submissions that engage with both the specifics of the situation and the broader themes of the class will be rewarded with higher grades. No case assignment submissions are required for the first week, but it is <b>critical</b> to read the FERC Energy Primer before the first class, which provides base knowledge of electricity markets. Each week's case study assignments are worth 10% of the final grade and are due by the beginning of class on the dates shown in the Class Outline section of this syllabus.	See weekly due dates in the Class Outline section of this syllabus.
Quizzes	30%	The students will take 3 quizzes. Each quiz is worth 10% of the final grade. Quiz content is derived from instruction material covered during the week. Students will be able to start the quiz the day following Thursday classes at 12:01 am and are due at 11:59 pm on the dates shown.	Quiz #1: Due Nov 6, 2021 Quiz #2: Due Nov 13, 2021 Quiz #3: Due Nov 20, 2021
Final Research Presentation	20%	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. Presentation must also include hedging and risk management recommendations. Students must have the trend they will analyze for the presentation selected by the end of Week 3, where it must be approved by the instructor.	Executive Summary: Due Dec 1, 2021 at 6:00pm  Group presentations occur on Dec 2, 2021 during class.

**Grading Policy:**

All questions and problems regarding grades must be presented in writing within one week after the test, homework, or project has been returned. The grading scale is fixed, please do not wait until the end of the quarter if you are concerned about the direction of your grade. Grades will be assigned based on all the work you have completed during the semester using the following scale:

<b>A</b>	93.333 to 100	<b>C</b>	73.333 to 76.666
<b>A-</b>	90.000 to 93.333	<b>C-</b>	70.000 to 73.333
<b>B+</b>	86.666 to 90.000	<b>D+</b>	66.666 to 70.000
<b>B</b>	83.333 to 86.666	<b>D</b>	63.333 to 66.666
<b>B-</b>	80.000 to 83.333	<b>D-</b>	60.000 to 63.333
<b>C+</b>	76.666 to 80.000	<b>F</b>	< 60.000

**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.

"Energy primer: a handbook of energy market basics" Federal Energy Regulatory Commission 2015

Khanna, Madhu. "COVID-19: A Cloud with a Silver Lining for Renewable Energy?"

**CLASS OUTLINE**

Weekly Topic	Description
<p><b>1: Introduction: Determinants of Demand/Supply and Nature of Energy + Electricity Markets</b></p> <p>Oct 28</p>	<ul style="list-style-type: none"> <li>● Introduction and course logistics.</li> <li>● 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.</li> <li>● 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.</li> <li>● Locational Marginal Pricing in electricity markets: three components of LMP, the energy cost, the congestion cost and the losses. Locational differences in pricing.</li> <li>● Determinants of demand and supply in energy markets: global commodity pricing, weather, economic activity, cost to carry, financing cost, OPEC intervention etc.</li> </ul> <p><b>Week 1 CASE STUDY – No case study submissions required. However, it is critical to read the Energy Primer by Oct 28<sup>th</sup> by 6:00pm</b></p> <ul style="list-style-type: none"> <li>● Energy primer: a handbook of energy market basics (required) (Federal Energy Regulatory Commission 2015)</li> <li>● What Smart Grid Means to an ISO/RTO? (optional) (Fan,Zhenyu)</li> <li>● Energy price risk and the sustainability of demand side supply chains (optional) (Mulhall, Rachel Ann, and John R. Bryson)</li> </ul> <p><b>321 Summary</b></p>
<p><b>2: Energy Commodity and Derivatives Trading</b></p> <p>Nov 4</p>	<ul style="list-style-type: none"> <li>● Basic understanding of investing in the energy commodity market. Different methods of investing in energy commodities: futures, options, swaps/CFDs, Fixed-for-Floating, PPAs, etc.</li> </ul>



	<ul style="list-style-type: none"> <li>● Understanding energy derivatives as a means to reduce commodity price risk.</li> <li>● Understanding basis risk: calendar basis risk, locational basis risk, and how “basis blowout” can destroy a buyer’s or seller’s futures hedge.</li> <li>● Hedging against commodity price risk: energy futures, swaps, and options as methods of risk management.</li> <li>● Understanding why merchant energy and electric power assets such as firm transmission capacity, storage, processing, and generating plants are valuable call options on spreads, and how access to these assets gives energy traders a significant advantage.</li> <li>● Understanding what asset “optionality” and “trading around assets” mean.</li> <li>● Use of energy derivatives to offset risk associated with doing business: how do big oil and gas companies like Chevron, BP, Shell use derivatives?</li> </ul> <p><b>Quiz #1</b> – Due Nov 6<sup>th</sup> by 11:59pm</p> <p><b>Week 2 CASE STUDY</b> – All cases are required reading and case assignment is due Nov 11<sup>th</sup> by 6:00pm</p> <ul style="list-style-type: none"> <li>● Electricity Derivatives and Risk Management (Deng, S, Oren)</li> <li>● Hedging or Speculation in Derivative Markets (Ciner, Detin)</li> <li>● Exploring Risk-Based Approaches for ISO/RTO Asset Managers (A. Roark, P. Skantze and R. Masiello)</li> </ul> <p><b>321 Summary</b></p>
<p><b>3: Energy Commodity and Derivatives Trading (Continued)</b></p> <p>Nov 11</p>	<ul style="list-style-type: none"> <li>● Understanding why energy companies financially hedge</li> <li>● Understanding the difference between price hedgers and spread hedgers</li> <li>● How to create buyer and seller futures hedges with physically and financially settled futures contracts and swaps</li> <li>● Understanding the forward curve, contango and backwardation. What is the relationship between the nature of the forward curve/ future contract and arbitrage opportunities?</li> <li>● 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?</li> <li>● 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.</li> <li>● Understanding the basics of heat-rate linked power transactions and why this technique is a powerful electricity risk management and deal structuring tool</li> </ul> <p><b>Quiz #2</b> – Due Nov 13<sup>th</sup> by 11:59</p> <p><b>Week 3 CASE STUDY</b> All cases are required reading and assignment is due on Nov 11<sup>th</sup> by 6:00pm</p>



	<ul style="list-style-type: none"> <li>• COVID-19: A cloud with a Silver Lining for Renewable Energy (Khanna, Madhu)</li> <li>• Managing Market Risk in Energy (M. Denton, A. Palmer, R. Masiello and P. Skantze)</li> </ul> <p><b>321 Summary</b></p>
<p><b>4: Miscellaneous Topics:</b> Futures, Trading Indexes, Physical Trading, Comparisons, Course Review</p> <p>Nov 18</p>	<ul style="list-style-type: none"> <li>• How real-world issues can impact futures hedging</li> <li>• How to hedge energy and electricity price risk with CME and ICE financial futures contracts</li> <li>• Trading indexes for energy commodities: indexes such as NYMEX for crude oil, brent crude and refined products such as kerosene and heating oil.</li> <li>• Comparisons with water/food/gas trading in terms of market structure and key derivatives.</li> <li>• Overview of the large and private ICE OTC over-the-counter electronic energy market, the importance of liquidity, how the "ICE" and CME-Globex trading platforms work, and how trades are cleared through the CME Clearinghouse and ICECLEAR.</li> </ul> <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><b>Quiz #3</b> Due Nov 20<sup>th</sup> by 11:59</p> <p><b>Week 4 CASE STUDY</b> All cases are required reading and assignment is due on <b>Nov 18<sup>th</sup></b> by 6:00pm</p> <ul style="list-style-type: none"> <li>• Beyond Enron: Regulation in Energy Derivatives Trading (Brunet, Alexia)</li> <li>• Heat Rate Call Options: There is no Heat When It Is Really Cold</li> <li>• Hedging Against Oil Dependency: New Perspectives on China's Energy Security Policy (Tunsjø, Øystein)</li> </ul> <p><b>321 Summary</b></p>
<p><b>5: FINAL PRESENTATION WEEK</b></p> <p>Dec 2</p>	<p>Final Presentation Executive Summary is due (electronically) by Dec 1<sup>st</sup>, at 6:00pm.</p> <p>Students will present their final presentations on Dec 2<sup>nd</sup> during class.</p>

**COVID-19 Classroom Expectations Statement**

Students, faculty, and staff must comply with University expectations regarding appropriate classroom behavior, including those outlined below and in the [COVID-19 Code of Conduct](#). With respect to classroom procedures, this includes:

- Policies regarding masking and social distancing evolve as the public health situation changes. Students are responsible for understanding and complying with current masking, testing, Symptom Tracking, and social distancing requirements.
- In some classes, masking and/or social distancing may be required as a result of an Americans with Disabilities Act (ADA) accommodation for the instructor or a student in the class even when not generally required on campus. In such cases, the instructor will notify the class.

- No food is allowed inside classrooms. Drinks are permitted, but please keep your face covering on and use a straw.
- Faculty may assign seats in some classes to help facilitate contact tracing in the event that a student tests positive for COVID-19. Students must sit in their assigned seats.

In the event that a student fails to comply with the [COVID-19 Code of Conduct](#) or other University expectations related to COVID-19, the instructor may ask the student to leave the class. The instructor is asked to report the incident to the Office of Community Standards for additional follow-up.

It is also the policy of the MSES Program that all lectures will be recorded and offered in a synchronous, hybrid format. On in-person days there will always be a synchronous Zoom option for any students that feel ill or are uncomfortable coming to class. If the professor needs to alter this schedule, they will aim to announce the changes at least 24 hours in advance.

### **Class Recording**

This class or portions of this class will be recorded by the instructor for educational purpose and available to the class during the quarter. Your instructor will communicate how you can access the recordings. Portions of the course that contain images, questions or commentary/discussion by students will be edited out of any recordings that are saved beyond the current term.

Unauthorized student recording of classroom or other academic activities (including advising sessions or office hours) is prohibited. Unauthorized recording is unethical and may also be a violation of University policy and state law. Students requesting the use of assistive technology as an accommodation should contact [AccessibleNU](#). Unauthorized use of classroom recordings – including distributing or posting them – is also prohibited. Under the University’s [Copyright Policy](#), faculty own the copyright to instructional materials – including those resources created specifically for the purposes of instruction, such as syllabi, lectures and lecture notes, and presentations. Students cannot copy, reproduce, display, or distribute these materials. Students who engage in unauthorized recording, unauthorized use of a recording, or unauthorized distribution of instructional materials will be referred to the appropriate University office for follow-up.

### **Expectations for Class Participation**

Being prepared for class is about more than just showing up, it’s also about making sure you’ve completed the readings, homework, etc. so that you are able to make thoughtful contributions during class. Sitting silently and/or being unprepared can damage your participation grade. When in a virtual class, we expect students to keep their camera and mute on as much as possible. When in the classroom, we expect students to keep their phones off and put away.

### **Academic Integrity**

Academic integrity is taken very seriously at Northwestern. Students are responsible for reading and understanding Northwestern’s Academic Integrity policies. All suspected violations will be reported to the McCormick College of Engineering’s Dean’s Office. These include cheating, plagiarism, fabrication, unfair advantage, unauthorized collaboration, and aiding and abetting of academic dishonesty. Students found in violation of academic integrity may receive a zero on the assignment or a failing grade for the course and may be suspended or permanently expelled from the University. See [Academic Integrity: A Basic Guide](#) for more information.

### **Accessibility Statement**

Northwestern University is committed to providing the most accessible learning environment as possible for students with disabilities. Should you anticipate or experience disability-related barriers in the academic setting, please contact AccessibleNU to move forward with the university’s established accommodation process (e: [accessiblenu@northwestern.edu](mailto:accessiblenu@northwestern.edu); p: 847-467-5530). If you already have established



accommodations with AccessibleNU, please let me know as soon as possible, preferably within the first two weeks of the term, so we can work together to implement your disability accommodations. Disability information, including academic accommodations, is confidential under the Family Educational Rights and Privacy Act.

### **Illness and Medical Leave of Absence**

Review the University's [policy](#) on missing academic work due to illness. Your instructor cannot waive an assignment missed due to illness unless the illness can be verified (e.g., by University Health Services or other licensed health professionals).

### **Discrimination and Sexual Harassment**

Northwestern's Policies on Discrimination, Harassment, and Sexual Harassment apply to all members of the University community, including students, staff, faculty, and third parties. Any student, staff, faculty member, or third party who believes that they have been discriminated against or harassed on the basis of their race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, pregnancy, parental status, marital status, age, disability, citizenship, veteran status, genetic information or any other classification protected by law, should contact the Office of Equity at (847) 467- 6571. Additional information about the University's discrimination and harassment policies, including the campus resources available to assist individuals with discrimination or harassment concerns, is available online on the [Office of Equity Website](#). Students, staff, and faculty who report harassment, discrimination, or sexual misconduct are also protected under the [University's Policy on Non-Retaliation](#).

### **Sexual Misconduct and Reporting**

Northwestern University is committed to fostering an environment where students are safe and free from sexual misconduct. [Confidential resources](#) are available to those who have experienced sexual misconduct. Faculty and instructors are not confidential resources and are required to report incidents of sexual misconduct, whether discussed in your assignments or in person, to the Office of Equity, which can provide information about resources and options. We encourage students who have experienced sexual misconduct to talk with someone to get support. For more information, including how to request interim protective measures and academic accommodations or file a complaint, see the [Get Help page](#).

### **Other Resources**

Students can find useful resources for safety and security, academic support, and mental and physical health and well-being at the [NUhelp website](#).