**University of New York at Stony Brook**

**Economics 373**

**Economics of Environmental and Natural Resources**

Winter 2024 (1/7/2025-1/24/2025)

Online Asynchronous

# Instructor and Contact Information

Instructor: Dana Golden

Office: SBS S-630

Office Hours: Monday through Friday 4pm– 5pm and by appointment

Email: Dana.Golden@stonybrook.edu

# Course pre-requisites

C or higher in ECO 303 and ECO 305.

*If you do not satisfy the pre-requisites you should rethink whether you are prepared to take the class.*

# General Education and University Credits

Credits: 3

DEC: H

SBC: STAS

# Suggested Textbooks:

* *Tietenberg, T. and Lewis, L., Environmental & Natural Resource Economics, 12th Edition*
* *Daniel Ahn, Principles of Commodity Economics and Finance*

The first half of the course focuses on environmental economics and follows *Environmental & Natural Resource Economics* while the second half of the course focuses on natural resource economics and *follows Principles of Commodity Economics and Finance*. Both textbooks are highly encouraged but option. Not all material will come from the textbooks, but the overlap is significant.

# Optional Readings and References:

* *Daniel J. Phaneuf and Tilman Requate, A Course in Environmental Economics*
* *Thomas Hieronymus, L., Economics of Futures Trading*
* *Geoffrey Rothwell, Economics of Nuclear Power*
* *Zechun Hu, Energy Storage for Power System Planning and Operation*
* *Todd Aagaard and Andrew Kleit, Electricity Capacity Markets*
* *Daniel Sadi Kirschen and Goran Strbac, Fundamentals of Power System Economics*
* *Steven W. Blume, Electric Power System Basics for the Nonelectrical Professional*
* *Michael Shin, Jonathan Campbell, and Sierra Burkhart, Essentials of Geographic Information Systems*

# Course Description, Objective and Topics

**Course Description:** This course is designed to provide an introduction to Environmental and Natural Resources Economics. The first half of the course will focus on environmental economics. This will include an overview of environmental economics topics, an introduction to externalities, cost-benefit analysis, data in environmental economics, non-market valuation, and dynamic efficiency and sustainable development. The second half will focus on natural resource economics with a particular emphasis on energy markets. My research focuses on energy and commodity markets, so I hope to give you a very practical and empirical take on the current state of energy markets.

**Learning Objectives:** Students completing this course will be able to:

* Conduct a Cost-Benefit Analysis for Environmental Policy and apply it to real world examples.
* Utilize discounting to determine net present value and levelized cost of energy and to analyze the value of projects.
* Analyze insurance markets and markets with imperfect information.
* Place a dollar value on the environment by using different valuation methods.
* Perform basic operations with Geographic data and understand the structure of geographic information systems.
* Use discrete choice modelling to perform non-market valuation.
* Utilize the Hotelling and Hubbert Peak models to analyze commodity market supply.
* Utilize Nerlove’s Partial Adjustment model to analyze commodity market demand.
* Explain economically why contango and backwardation might emerge and how basis is determined.
* Understand the basics of commodities markets derivatives, pricing, portfolio creation, and regulation.
* Perform basic techno-economic analysis with the example of nuclear power.
* Explain the basics of electricity markets including transmission, generation, and distribution, locational marginal price, electricity market bidding strategy, the role of energy storage systems, how capacity markets operate, and the impact of renewable energy generation
* Explain the science of climate change, including both the sources and likely outcomes of climate change. Evaluate different policy options for climate change, as well as policy timing.
* Distinguish between maximum sustainable yield and static-efficient sustainable yield, by developing Schaefer model.
* Explain the relationship between economic growth and the welfare of the population.

**Structure of Course Topics:**

* Lecture 1: Introduction to Environmental Economics
* Lecture 2: Externalities, public goods, and markets
* Lecture 3: Imperfect Information and Insurance Markets
* Lecture 4: Cost-benefit Analysis
* Lecture 5: Non-market Valuation
* Lecture 6: Environmental Macroeconomics
* Lecture 7: Data in environmental Economics and Geographic Information Systems
* Midterm
* Lecture 8: Commodity Markets
* Lecture 9: Commodity Market Derivatives
* Lecture 10: Electricity Markets
* Lecture 11: Bidding in Electricity Markets
* Lecture 12: Economics of Nuclear Power
* Lecture 13: Capacity Markets
* Lecture 14 (optional): Environmental justice
* Final

The weekly schedule of topics together with the relevant textbook chapters is provided below. This is tentative and provided to give you an overview of what’s coming. You are expected to check Blackboard regularly for updates during the semester.

# Assessment

**Grading:** There will be five problem sets (one per week). There are also two routes you are allowed to take. You can **either** take the midterm and final or you can complete a project. You must commit to a route by the week before the midterm. If you do not reach out that you will be doing the project, it will be assumed that you will take the midterm and final. If you do the project, you are not required to take either, and neither will be graded. You must hand in all the assignments AND watch all lectures. Problem sets will be 50% of the grade while the other 50% will either be split between the midterm and final or placed on the project. The final is **not** cumulative.

**Assignments (50%):** Assignments are due weekly and focus on the current week’s coursework. Whereas tests will focus on broader knowledge and general understanding of models, assignments will focus on analytical skills and ability to carry out the steps of the tools you learn in class. Assignments will be math-based, and some will require you to utilize data and coding. An optional lecture will be uploaded on how to use R for new users alongside materials related to the software.

**Exams (50%)**: Exams are one option. Exams will be online through Brightspace and will be proctored using online monitoring software. You will have a one week window within which to take the exam. Exams are closed book. No graphics or programming calculators or any other gadgets such as cell phones, tablets etc. will be allowed. If you have questions about the way exams are graded or if you want a regrade, you can submit a brief statement in writing explaining your concern or why you think a reconsideration of your work is appropriate within three class days of the day the grades are posted. You are more than welcome to come during office hours to check your exams and discuss how you can improve on your understanding the material. If you have an accommodation through the office of disability services, you are welcome to reach out. If something happens that makes it difficult to take the exam before the end of the one week period, please reach out to me **before** the end of the one week period. No extensions will be granted after the exam period is up.

**Project (50%)**: The project is the other option. The project can be done individually or in a group of up to three people. Three project options are provided in the project description. You must reach out to me to discuss the project you are planning and get approval before confirming the project option. I just need sufficient evidence you have thought about it.

**Academic Dishonesty Policy:** *We take academic integrity very seriously.* You are expected to complete assignments **on your own**. Any assignment submission suspected of cheating (identical or near identical to a classmate or solicited from someone else) will be reported to the Academic Judiciary with a suggested penalty of F for the class and potentially further repercussions for your standing in the university. The same applies to anyone attempting to cheat during an exam, including not following the rules about closed books and allowed calculators.

**Final Exam Due Date: Friday January 24th**

# How to Succeed in the course

**Weekly Responsibilities**: Every week you will need to

1. Watch lectures and actively engage with material.
2. Log in on Brightspace at least twice a week to check announcements, lecture slides and download assignments.
3. Complete assignments before the deadline. Late assignments are not accepted except under extraordinary circumstances.
4. (Optional but strongly recommended): Stay in contact with the instructor by visiting office hours and clarifying any remaining issues pertaining to lectures and assignments.

 **Required Software:** The course will require R and Excel but at a very basic leve.

**Course Related (academic) Help:** If you have questions or difficulties with the material covered it is important that you ask for help early rather than late. You can do this during the instructor’s office hours or email the instructor directly.

**Academic Success and Tutoring Center:** If you need additional help, the university also provides academic success and tutoring services. Information can be found

at: [http://www.stonybrook.edu/commcms/academic\_success/](https://t.e2ma.net/click/nktlte/fejrv4/7nxecub)

**Writing Center:** If you need additional help with any writing in the class, the university also provides a writing tutoring center. Information can be found

at: <https://www.stonybrook.edu/writingcenter/>

**Brightspace Technical Assistance:**

You can access class information on-line at: <https://it.stonybrook.edu/services/brightspace>Please check Brightspace regularly for posted assignments and other announcements.

Stony Brook has contracted with SUNY's Helpdesk so that support is available to instructors & students 7 days a week, nights and weekends. Visit [https://online.suny.edu/help/](https://t.e2ma.net/click/4vaa1g/kgtmok/say0wm) for hours and contact information. In the event that the SUNY help desk is busy, you will be transferred to Brightspace for support.

If you need technical assistance at any time during the course or to report a problem with Brightspace you can:

* Submit a help ticket on the web at [http://it.stonybrook.edu/services/itsm)](http://it.stonybrook.edu/services/itsm)
* Call (631) 632-9800 (technical support, log-in issues, computer support, Wi-Fi, software & hardware)

**Comments:** If you have any comments or suggestions about the course, or you need to contact me directly, please send me an e-mail message and we will make an appointment.

**UNIVERSITY POLICIES**

# Student Accessibility Support Center Statement (SASC)

If you have a physical, psychological, medical, or learning disability that may impact your course work, please contact the Student Accessibility Support Center, 128 ECC Building, (631) 632-6748, or at sasc@stonybrook.edu. They will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: [https://ehs.stonybrook.edu//programs/firesafety/emergency-evacuation/evacuation-guide-disabilities](https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-disabilities)  and search Fire Safety and Evacuation and Disabilities.

# Academic Integrity

Each student must pursue his or her academic goals honestly and be personally accountable for all submitted work. Representing another person's work as your own is always wrong. Faculty is required to report any suspected instances of academic dishonesty to the Academic Judiciary. Faculty in the Health Sciences Center (School of Health Technology & Management, Nursing, Social Welfare, and Dental Medicine) and School of Medicine are required to follow their schoolspecific procedures. For more comprehensive information on academic integrity, including categories of academic dishonesty, please refer to the academic judiciary website at[http://www.stonybrook.edu/commcms/academic\_integrity/index.html](https://www.stonybrook.edu/commcms/academic_integrity/index.html)

# Assistance During Emergency Evacuation

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and the Student Accessibility Support Center. For procedures and information go to the following website: [https://ehs.stonybrook.edu/programs/firesafety/emergency-evacuation/evacuation-guide-people-physical-disabilities](https://ehs.stonybrook.edu/programs/fire-safety/emergency-evacuation/evacuation-guide-people-physical-disabilities)  and search Fire Safety and Evacuation and Disabilities.

**Critical Incident Management:**

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of University Community Standards any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn. Faculty in the HSC Schools and the School of Medicine are required to follow their school-specific procedures. Further information about most academic matters can be found in the Undergraduate Bulletin, the Undergraduate Class Schedule, and the Faculty-Employee Handbook

# Course Materials and Copyright Statement

Course material accessed from Blackboard, SB Connect, SB Capture or a Stony Brook Course website is for the exclusive use of students who are currently enrolled in the course. Content from these systems cannot be reused or distributed without written permission of the instructor and/or the copyright holder. Duplication of materials protected by copyright, without permission of the copyright holder is a violation of the Federal copyright law, as well as a violation of Stony Brook's Academic Integrity and Student Conduct Codes.

## (Tentative) Weekly Schedule of Topics and Readings

### Lecture 1: Introduction to Environmental Economics (Chapter 1)

1. Introduction to Class
2. Review of microeconomics
3. Basics math review
4. Basics of environmental economics

### Lecture 2: Externalities, public goods, and markets (Chapters 3 and 15)

1. Markets Mathematically
2. Externalities
3. Congestion Games
4. Public Goods

### Lecture 3: Imperfect Information and Insurance Markets (Chapter 4)

1. Imperfect Information.
2. Insurance markets.

### Lecture 4: Cost-benefit Analysis (Chapter 3)

1. Discussion of framework
2. Discounting and valuation
3. LCOE and LACE
4. Benefits
5. Costs

###  Lecture 5: Non-market Valuation (Chapter 4)

1. Non-market valuation basics
2. Revealed Preference methods
3. Stated Preference methods
4. Discrete Choice methods

### Lecture 6: Environmental Macroeconomics (Chapters 5-6)

1. Introduction to environmental macroeconomics
2. Environmental macroeconomics of growth
3. Integrated assessment models
4. Trade models
5. ESG investing

### Lecture 7: Data in environmental Economics and Geographic Information Systems

1. Basics of Modelling and Data Analysis
2. Finding Environmental Data
3. Environmental Data Analysis
4. Introduction to GIS
5. Visualizing Geographic Data
6. Analyzing Geographic Data

**MIDTERM EXAM:** Covers Material in Lectures 1-7.

### Lecture 8: Commodity Markets (Chapters 1-3 Commodities textbook)

1. Commodities markets
2. Commodity market supply (Hotelling, Hubbert Peak, Industry Supply Curves)
3. Commodity market demand

###  Lecture 9: Commodity Market Derivatives (Chapters 6-8+10)

1. Fundamentals of derivatives
2. Working-Kaldor, Kenyes-Hicks
3. Price discovery
4. Valuation and portfolio choice
5. Market Microstructure and regulation
6. Prediction markets and the order book

### Lecture 10: Electricity Markets (Chapter 11)

1. Basics of electricity
2. Generation
3. Transmission

### Lecture 11: Bidding in Electricity Markets (Chapter 11)

1. A basic model of bidding
2. Renewable Bidding
3. Energy Storage Systems
4. Electricity Market Derivatives

### Lecture 12: Economics of Nuclear Power (Chapter 11)

1. Nuclear Energy Basics
2. Costs of Nuclear Power
3. New Nuclear Capital Costs
4. Generation Portfolios

### Lecture 13: Capacity Markets (Chapter 11)

1. Capacity Market Basics
2. Capacity Markets in Practice
3. Market Equilibrium
4. Market Design
5. The Texas Alternative

### Week 14: Environmental Justice (Optional)

1. Environmental justice
2. Bias in metals market

**FINAL EXAM:** Covers material in after Midterm.