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Spring 2020

## EVSC 325-102: Energy and Environment (Revised for Remote Learning)

Michael Hornsby

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## **EVSC 325 Energy and Environment**

### **Course Syllabus**

### **Spring 2020**

### **Rev. 3 28 2020**

- Class Website: <https://njit.instructure.com/courses/9137>
- Class Meeting Time: 6:00 pm - 8:50 pm each Monday evening from Jan 27, 2020 to May 4, 2020 (Except for Spring Break March 16)
- Location: ~~Faculty Memorial Hall, Classroom 305~~  
Online via Webex as of March 16, 2020
- Instructor: Michael Hornsby
- E-mail: hornsby@njit.edu Cell Phone: 609-529-6875
- Profile: <https://www.linkedin.com/in/mikehornsby>
- Office Hours: ~~Mondays, 8:50 P.M., Faculty Memorial Hall 305~~
  - Via telephone and email as of March 16, 2020

#### COURSE INFORMATION

##### I. Course Description and Objectives Summary:

The course is a study about energy production and use, and the resulting climate and other environmental impacts. The class will examine:

- Energy fundamentals
- International, national and state energy production and usage trends
- Primary forms of energy production: coal, oil, natural gas, nuclear and renewable energy (solar, wind and renewable natural gas)
- Electricity generation with fossil fuels and nuclear power
- Transmission, distribution and electric utilities
- New Jersey energy programs and energy master plan
- Microgrids, energy storage and fuel cells – distributed energy resources (DER)

- Energy efficiency and peak reduction
- Building electrification, including geothermal
- Transportation electrification
- Waste to energy
- Climate change science, policy and carbon pricing
- Climate resilience
- Environmental trends including air quality, water quality, wastewater, waste and land use impacts from energy generation, transmission, distribution and use
- Sustainability of energy systems and resources
- Perspectives from industry and environmental groups
- The future of energy

Number of Credits: 3 Credits

Prerequisites: EVSC 125. Fundamentals of Environmental Sciences and CHEM 125: General Chemistry I

Required Textbook:

Title	Textbook: Energy: Its Use and the Environment, 5th Edition
Author	Roger A. Hinrichs, Merlin H. Kleinbach
Edition	5 <sup>th</sup> edition, 2013
Publisher	Brooks/Cole
ISBN #	ISBN-10: 1111990832

The textbook has its own website with supplemental materials: [https://www.cengage.com/cgi-wadsworth/course\\_products\\_wp.pl?fid=M20b&product\\_isbn\\_issn=9781111990831&token=C96CBF5FE1B17F4D016FCF75E7EF88699C2692559818209ACA6658502EE6EA201F378713BF544CA4B82C14C91A7EF21CF8A5EC26D5BE3AAD13EA478F92D2730BFBD3F7B14F75E020](https://www.cengage.com/cgi-wadsworth/course_products_wp.pl?fid=M20b&product_isbn_issn=9781111990831&token=C96CBF5FE1B17F4D016FCF75E7EF88699C2692559818209ACA6658502EE6EA201F378713BF544CA4B82C14C91A7EF21CF8A5EC26D5BE3AAD13EA478F92D2730BFBD3F7B14F75E020)

University-wide Withdrawal Dates: Withdrawal dates are posted on the NJIT academic calendar: <https://www5.njit.edu/registrar/>

II. Learning Outcomes: Student learners will:

- Understand baseline energy, economic and environmental conditions
- Understand the science and physics of energy

- Understand how energy is produced, transported and used, and its resulting environmental impacts
- Understand the need to electrify everything, and the means to produce clean energy and the timeframes needed
- Understand transportation electrification
- Understand the several forms of climate resilience
- Understand the gravity of climate change and their ability to address it
- Understand technological and policy solutions
- Understand the institutions, politics and people in the energy field
- Understand the energy data evaluation and energy planning tools available
- Learn about the future of energy
- Understand how to develop an energy plan
- Understand that it is possible to build a career around solving the world's greatest problems

**POLICIES**

All EVSC students must familiarize themselves with, and adhere to, all official university-wide student policies. EVSC takes these policies very seriously and enforces them strictly.

Grading Policy: The final score in this course will be as follows:

Assignments – Including Energy Plan	20
Quizzes	15
Participation	5
Midterm Exam	30
Final Exam	30
Extra Credit	0

The final course grade will be determined as follows:

Final Grade	Overall Academic Performance (100%)
A	Above 90
B+	85-89
B	80-84
C+	75-79
C	70-74

D	60-69
F	Below 60

Attendance Policy: Attendance at classes will be recorded and is mandatory. Each class is a learning experience that cannot be replicated through simply “getting the notes.”

Homework Policy: Homework is an expectation of the course. The homework assignments set by the instructor are used in class discussions which comprise in part the determination of the score for “participation”. One Homework assignment will include the development of an energy plan, based on the tools and processes discussed in the class. The energy data and the economic and environmental assessment tools will be discussed in the class schedule below.

Exams: There will be two quizzes, a midterm exam held in class during the semester and one final exam. The following exam periods are tentative and therefore possibly subject to change:

Midterm Exam	March 9
Quizzes	Quiz 1: Feb. 24    Quiz 2: April 13
University Final Exam Period	May 8-14

Makeup Exam Policy: There will normally be NO MAKE-UP QUIZZES OR EXAMS during the semester. In the event that a student has a legitimate reason for missing a quiz or exam, the student should contact the Dean of Students office and present written verifiable proof of the reason for missing the exam, e.g., a doctor’s note, police report, court notice, etc. clearly stating the date AND time of the mitigating problem. The student must also notify the CES Department Office/Instructor that the exam will be missed. If a make up is allowed, it will be more substantially difficult than the original quiz or exam.

Cellular Phones: All cellular phones must be silenced switched off during class times.

## Schedule

- See the Pages section within each weekly online Module for details including: Introduction, Agenda, Learning Objectives, Assignments and Files/References
- The Course Schedule is subject to change, to accommodate the availability of guest speakers.

<b>Date</b>	<b>Topic &amp; Presenter</b>
Week 1 Jan. 27	<ul style="list-style-type: none"> <li>• Topic: Course Overview. Review of syllabus and website, learning outcomes and expectations. Presenter: Mike Hornsby</li> <li>• Topic: Overview of International Energy Generation and Usage Presenter: Mike Hornsby Text Chapters 1, 6, 7, and 12</li> </ul>
Week 2 Feb. 3	<ul style="list-style-type: none"> <li>• Topic: Overview of US Energy Information Administration, US Department of Energy and New Jersey State energy data</li> <li>• Introduction to the State's Energy Master Plan (EMP) and Integrated Energy Plan (IEP)</li> <li>• Average energy household use and carbon footprint</li> <li>• Presenter: Mike Hornsby</li> <li>• Text Chapters 1, 6, 7 and 12</li> <li>• Topic: Climate Change and Carbon Fee and Dividend</li> <li>• Presenter: Mike Aucott, Volunteer, Citizens Climate Lobby</li> </ul>
Week 3 Feb. 10	<ul style="list-style-type: none"> <li>• Topic: Waste to Energy</li> <li>• Presenter: Jyoti T. Agarwal, PhD, Environmental Manager, Covanta Holding Corporation</li> <li>• Text Chapter 17</li> <li>• Topic: Municipal Climate Action Plans</li> <li>• Presenter: Guest Speaker: Christine Symington, Sustainable Princeton</li> </ul> <p>Introduction to local energy management planning processes and procedures, local energy assurance planning processes</p>

<p>Week 4 Feb. 17</p>	<ul style="list-style-type: none"> <li>• Topic: Offshore Wind Power</li> <li>• Presenter: Brandon Burke, Business Network for Offshore Wind</li> <li>• Text Chapter 12E</li>   <li>• Topic: Solar Power and Energy Storage</li> <li>• Presenter: Lyle Rawlings, President, CEO of Advanced Solar Products</li> <li>• Text Chapter 6 and 12A through D</li> </ul>
<p>Week 5 Feb. 24</p>	<ul style="list-style-type: none"> <li>• Topic: An Industry Perspective on Energy and the Environment</li> <li>• Presenter: Dennis Hart, Executive Director, Chemistry Council of New Jersey</li>   <li>• Topic: Climate Resilience: Swiftwater/Flood Rescue Team</li> <li>• Presenter: Brian Doel, Assistant Chief, Princeton Junction Volunteer Fire Company</li>   <li>• QUIZ 1 – Take Home quiz Calculate your energy use</li> </ul>
<p>Week 6 Mar. 2</p>	<ul style="list-style-type: none"> <li>• Topic: Nuclear Fusion</li> <li>• Presenter: Andrew Zwicker, Head, Office of Communications and Public Outreach, Princeton Plasma Physics Laboratory. New Jersey Legislature – Assemblyman, Legislative District 16. Text Chapter 16</li> <li>• Topic: The Physics of Energy: This session will provide a general overview of the basic energy physics tools including the definition of energy, what are the different types and forms of energy, the units of energy and the laws of motion and thermodynamics related to energy. This will include an introduction to energy valuation methods and models to evaluate and assess energy systems and resources. Text Chapters 2 through 5</li>   <li>• Introduction to state energy planning and energy assurance planning processes and procedures</li> <li>• Presenter: Mike Hornsby</li>   <li>• Topic: Review for Midterm</li> <li>• Presenter: Mike Hornsby</li> </ul>



<p>Week 7 Mar. 9</p>	<ul style="list-style-type: none"> <li>• Topic: Renewable Natural Gas</li> <li>• Presenter: Brian Blair, Chief Operating Officer, Trenton Biogas, LLC</li> <li>• Text Chapter 17</li> <li>• <b>Midterm Exam</b></li> </ul>
<p>Mar. 16</p>	<p>Spring Break - No Class</p>
<p>Week 8 Mar. 23</p>	<ul style="list-style-type: none"> <li>• Topic: Climate Change</li> <li>• Presenter: Bernadette Woods Placky, Chief Meteorologist, Climate Matters Director Text Chapter 9</li> <li>• Topic: The Economics of Energy This session will provide a general overview of the basic economic tools including estimating the growth rate of energy resources, simple payback, return on investment (ROI), future costs and net present values. Presenter: Mike Hornsby</li> </ul>
<p>Week 9 Mar. 30</p>	<ul style="list-style-type: none"> <li>• Andrew Levitt, Sr. Business Solution Architect, Applied Innovation, PJM Interconnection: Electricity Transmission</li> <li>• Text Chapter 11C</li> <li>• Topic: Sustainable Jersey</li> <li>• Presenter: Randall Solomon, Executive Director (invited)</li> </ul>
<p>Week 10 Apr. 6</p>	<ul style="list-style-type: none"> <li>• Topic: Green Buildings - Energy Efficiency</li> <li>• Presenter: Wayne D. DeFeo, LEED AP USGBC NJ Executive Director</li> <li>• Text Chapter 5</li> <li>• Electricity Generation (Fossil and Nuclear): Mark Scorsolini, PSEG Energy Resources and Trade</li> <li>• Text Chapters 7, and 14</li> </ul>
<p>Week 11 April 13</p>	<ul style="list-style-type: none"> <li>• Topic: Insurance Industry Perspective on Climate Change Presenter: Mark Bove Munich Re</li> </ul>

	<ul style="list-style-type: none"> <li>• Topic: Natural Gas &amp; Electricity Transmission &amp; Distribution Presenter: Paul Drake, Regional Public Affairs Manager, PSE&amp;G</li> </ul>
Week 12 April 20	<ul style="list-style-type: none"> <li>• Topic: Microgrids: This session will include an overview of the current electric generation, transmission and distribution systems and infrastructure and an overview of the definition and use of microgrids in that overall electric system. This will include the energy, economic and environmental assessment tools that have been provided in previous sessions.</li> <li>• Presenter: Mike Hornsby</li> <li>• Topic: Wholesale Electricity Markets and Energy Price Forecasting</li> <li>• Presenter: Joshua Danial, Power Analyst, North America, BloombergNEF</li> </ul>
Week 13 Apr. 27	<ul style="list-style-type: none"> <li>• Topic: The Environmental Assessment of Energy This session will provide a general overview of the basic environmental evaluation tools to assess the relative environmental impacts of energy systems and resources. This will include an introduction to life cycle analysis (LCA) methods and models. Text Chapter 8 and 9 Presenter: Mike Hornsby</li> <li>• Topic: Energy Planning</li> <li>• This session will review the energy planning tools and the energy, economic and environmental assessment tools that have been provided in previous sessions in order to complete the energy plan</li> <li>• Presenter: Mike Hornsby</li> </ul>
Week 14 Week of May 4, 2020	<ul style="list-style-type: none"> <li>• Topic: Resilience Against Climate Change</li> <li>• Presenter: Mike Hornsby</li> <li>• Review for Final Exam</li> </ul>

TBD	<ul style="list-style-type: none"> <li>• Topic: Electric Vehicles Presenter: Mike Hornsby</li>   <li>• Topic: Global Energy Perspective Presenter: David Crane</li> </ul>
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## ADDITIONAL RESOURCES

Accommodation of Disabilities: Office of Accessibility Resources and Services (*formerly known as Disability Support Services*) offers long term and temporary accommodations for undergraduate, graduate and visiting students at NJIT. If you need accommodations due to a disability please contact Chantonette Lyles, Associate Director at the Office of Accessibility Resources and Services at 973-596-5417 or via email at [lyles@njit.edu](mailto:lyles@njit.edu). The office is located in Fenster Hall Room 260. A Letter of Accommodation Eligibility from the Office of Accessibility Resources Services office authorizing your accommodations will be required. For further information regarding self-identification, the submission of medical documentation and additional support services provided please visit the Accessibility Resources and Services (OARS) website at:

<http://www5.njit.edu/studentsuccess/disability-support-services/>

### Statement on Academic Integrity

*“Academic Integrity is the cornerstone of higher education and is central to the ideals of this course and the university. Cheating is strictly prohibited and devalues the degree that you are working on. As a member of the NJIT community, it is your responsibility to protect your educational investment by knowing and following the academic code of integrity policy that is found at: <http://www5.njit.edu/policies/sites/policies/files/academic-integrity-code.pdf>.*

*Please note that it is my professional obligation and responsibility to report any academic misconduct to the Dean of Students Office. Any student found in violation of the code by cheating, plagiarizing or using any online software inappropriately will result in disciplinary action. This may include a failing grade of F, and/or suspension or dismissal from the university. If you have any questions about the code of Academic Integrity, please contact the Dean of Students Office at [dos@njit.edu](mailto:dos@njit.edu)”*