EST 694
Energy and Buildings – Technology, Policy, and Behavior

Course Details:
Semester: Spring 2018
Day and Time: Tuesdays 12pm – 2:50pm
Meeting Place: Computer Science Seminar Room

Contact Information:
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Office location: Computer Science 1411
Office hours: Thursdays 12pm-3pm

Course Overview:
Buildings consume vast amounts of energy and resources, and are one of the largest contributors to greenhouse gas emissions. Major advances in building design and technology over the past decade have given us tools to make buildings more energy efficient, but buildings lag far behind their potential. There are many avenues to green the built environment sector, including technological innovations, occupant behavior programs, retrofits of existing buildings, and innovative building codes. Ultimately, reducing energy consumption in the building stock will require an interdisciplinary approach and some combination of a range of program and policy types.

This course will introduce students to the many interdisciplinary issues surrounding energy use in buildings, with a particular focus on the intersection of policy with technology, economics, social science, and behavior. The course will combine lectures, student-led discussions, guest speaker(s) and field trip(s) to green buildings, depending on scheduling.

Course Grading:
Mid-term exam (take home essay format): 30%
Final project and presentation (Suffolk County recommendations): 30%
Policy Briefings (2): 30%
Class Participation: 10%

Assignments:
Grading for this course will be based on the following four assignments/exams:

1.) Mid-term (30%): The mid-term exam will be posted to Blackboard on 3/20/2018. Class will be cancelled that day. You will have 24 hours to complete the exam and it will be open book (meaning you can use and refer to any of the readings from the course up that point). The exam will consist of three essay questions, of which two must be chosen and answered in the allotted class time. Each essay should be approximately 2 pages in length. More information, including the types of questions to expect, will be discussed in class a few weeks prior to the exam.

2.) Final project (30%): This semester will take a unique approach to the final project, since we have an opportunity to be involved in a real green building redevelopment project. Suffolk
County is developing plans to redesign the Suffolk County Farm Education and Visitors Center. When complete, this facility will promote the Suffolk County Farm and Cornell Cooperative Extension programs as well as Suffolk County’s agricultural and related tourism. I am involved with the energy subcommittee, and over the next two months we will be working as a class with the head architect for Suffolk County, the Senior Energy Analyst, members of the Cornell Cooperative Extension, consultants, and other members of the project team, to develop and formulate ideas for both the energy features for the site as well as the educational displays to communicate the energy efficiency features to visitors. Over the course of the semester you will be working together in two small groups to formulate ideas and strategies, and will present these ideas to the Suffolk County group at the end of the semester. You will also prepare a final memo to Suffolk County to communicate your recommendations in writing. We will have three class dates to work together after the lecture in class on this project as well.

3.) **Policy Briefings (30%)**: Students must sign up for *two* dates during the course of the semester to lead a discussion for that week on a current or recent policy development (locally, regionally, nationally, or internationally) pertaining to energy in the built environment (building materials, technology, behavior, rebates, incentives, education, etc). No written submission is expected or required, unless the student would like to prepare a handout for his/her classmates (not required). The discussion is informal – students should simply prepare ahead, present findings, and spur discussion amongst classmates on their chosen dates. What is the policy development? How does it impact the building industry? What will the impact on energy use be (if any)? Is it successful? (etc). Students should be prepared to share about 10-15 minutes worth of material, and have a 10-15-minute discussion/Q&A. Students will select two dates on the first day of class.

4.) **Class Participation (10%)**: Students are expected to participate actively in class discussions about reading materials and during policy briefings by classmates. Active participation from all members of the class helps to make our time more interesting and dynamic, and helps students engage with the course materials.

**Readings/Textbook:**

There is no *required* textbook for the course. Readings will be drawn from academic journals, book chapters, industry publications, and other sources, and will be posted on the Blackboard site for the course. Please note, readings may change as the semester progresses, and new articles and papers become available, but ample notice will be given, and the syllabus will be updated accordingly.

The following book may be interesting and helpful to students, but is *optional*:


**Class Structure:**

Classes will be split into three parts: Lecture, reading discussion, and policy briefing/final project work. Each class meeting will begin with a lecture on that week’s materials. Lecture length may vary, based on the topic. We will then discuss that week’s readings as a group. Please be prepared to offer your thoughts and input, and ask questions about the readings. The last portion of class will consist of the policy briefing(s) led by the student volunteer(s) for the week or as collaborative work time to spend advancing ideas on the final project together.
## Course Schedule:

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<th>WEEK</th>
<th>DATE</th>
<th>TOPIC</th>
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<td><strong>PART I: FRAMEWORK AND BACKGROUND FOR BUILDINGS AND ENERGY</strong></td>
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<tr>
<td>1</td>
<td>1/23/18</td>
<td>Introduction and overview</td>
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<td><strong>PART II: BEHAVIOR (MICRO SCALE – INDIVIDUALS, OCCUPANTS)</strong></td>
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<td>2</td>
<td>1/30/18</td>
<td>Human behavior and decision-making</td>
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<td><em>Suffolk County introductory meeting</em></td>
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<td>3</td>
<td>2/6/18</td>
<td>Human behavior case studies and strategies</td>
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<td><strong>PART III: TECHNOLOGY (MESO-SCALE – THE BUILDING)</strong></td>
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<td>4</td>
<td>2/13/18</td>
<td>Technology, innovation, and market transformation</td>
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<td>2/20/18</td>
<td>Building operations and management</td>
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<td>“Low-tech” building energy efficiency</td>
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<td>3/6/18</td>
<td><em>Suffolk County meeting (ON SITE AT FARM)</em></td>
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<td>8</td>
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<td>SPRING BREAK – NO CLASS</td>
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<td>3/20/18</td>
<td>MID-TERM (take-home) – NO CLASS</td>
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<td><strong>PART IV: POLICY (Macro scale – Communities, Institutions, Organizations; National/Global)</strong></td>
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<td>10</td>
<td>3/27/18</td>
<td>FIELD TRIP – Advanced Energy Conference 2018</td>
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<td>4/3/18</td>
<td>Data collection &amp; analysis for building energy use</td>
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<td>Building policy – regulations, incentives, building codes</td>
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<td>Equality and social justice in energy efficient buildings</td>
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<td>14</td>
<td>4/24/18</td>
<td>International examples – policies, buildings, technologies</td>
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<td>15</td>
<td>5/1/18</td>
<td>Final Presentations to Suffolk County / Last class</td>
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Lecture Descriptions and Readings:

PART I: FRAMEWORK AND BACKGROUND FOR BUILDINGS AND ENERGY

Week 1: January 23, 2018
Introduction & Overview
Introduction to course; situating buildings within the larger climate challenge; framework for the importance of buildings; overview of topics for the semester; overview of grading and assignments; sign-up for policy discussion leadership dates

Readings:

PART II: BEHAVIOR
(Micro Scale – Individuals, Occupants)

Week 2: January 30, 2018
Human behavior and decision-making
Framing the importance of the micro scale and the building occupant in energy consumption; understanding behavior in individuals and households; theories of behavioral outcomes; values, attitudes, and norms in energy consumption; major differences in energy consumption behavior in commercial properties vs residential properties; challenges that are unique to commercial buildings; behavior of occupants at work

Readings:

GUEST SPEAKER(s)—Suffolk County Farm redevelopment team/county officials
Representatives from Suffolk County and the Cornell Cooperative will join us to introduce the Suffolk County Farm redevelopment project.
**Week 3: February 6, 2018**

**Behavioral case studies and strategies**

A residential case study of the role of habits in occupant behavior in a NYC green building; a commercial case study of a portfolio of buildings in Philadelphia that studied the effects of load-shedding on occupant behavior and comfort; approaches to collecting data and researching occupant behavior; policy strategies to addressing behavior.

**Readings:**


**PART III: TECHNOLOGY**

(Meso-scale – The building)

**Week 4: February 13, 2018**

**Technology, Innovation, and Market Transformation**

Transforming the building industry; new advances in building connectivity and integration with the grid (e.g. smart buildings); scaling up technologies and interventions; a brief framework of theories of innovation and how market transformation occurs; placing buildings within this larger framework; comparing & contrasting buildings to other transformative technologies (electric vehicles, biofuels, etc.)

**Readings:**

- “What is a Smart Building.” (2011). Institute for Building Efficiency. (see Blackboard)
- “Diffusion of Innovation Theory.” (from Boston University Medical College – see Blackboard)
Week 5: February 20, 2018
Building Operations & Management
The importance of operations and management in influencing overall building energy consumption; organizational drivers of effective building management; can managers “override” occupant behavior; new technology in building controls and automation

Readings:

Week 6: February 27, 2018
Low-tech energy efficiency
Does it have to be “high-tech” to be green or energy efficient? An exploration of “low-tech” solutions to sustainable and energy efficient building practices; passive designs; historic buildings; building materials to increase insulation for heating and cooling; traditional and cultural building practices

Readings:

Week 7: March 6, 2018
FIELD TRIP AND GUEST SPEAKER(s)—Suffolk County Farm redevelopment team
We will visit the site of the Suffolk County Farm and will meet with representatives from Suffolk County and the Cornell Cooperative to discuss further aspects of the Farm redevelopment as the project has progressed. Students will be brought up to date on the latest developments and design plans, and have a chance to ask further questions and have a discussion about the county’s goals and desired outcomes from the project.

Week 8: March 13, 2018
SPRING BREAK – NO CLASS

Week 9: March 20, 2018
MID-TERM (take-home – essay format; see description on p.1 of syllabus) NO CLASS
PART IV: POLICY
(Macro scale – Communities, Institutions, Organizations; National/Global Issues)

Week 10: March 27, 2018
FIELD TRIP – Advanced Energy Conference 2018, Marriott Marquis, New York, NY
This year the Advanced Energy Center (AEC) is hosting the 2018 Advanced Energy Conference at the Marriott Marquis in New York City on March 26th, 27th, and 28th. I am sponsoring student attendance on the day of our class (3/27). The conference provides a number of educational sessions and has two tracks on buildings (Advanced Buildings I and Advanced Buildings II). Students should plan to attend on the 27th, but are free to attend more days if their schedule permits. We will meet at the conference. We will discuss in class if anyone needs help navigating public transportation to get to the event. Visit the conference website for more information on sessions: http://aertc.org/aec2018/.

Week 11: April 3, 2018
Data Collection & Analysis for Building Energy Consumption
What types of data exist for building energy researchers and practitioners; where is data found and made available online; different types of analysis for buildings; CBECS and RECS; Agent-based modeling; energy disclosure data

Readings:
- Please review (SKIM) the results of the EIA’s 2012 CBECS: http://www.eia.gov/consumption/commercial/reports/2012/buildstock/index.cfm

Week 12: April 10, 2018
Green and energy efficient building policy: Regulations, Incentives, Building Codes
Voluntary and mandated schemes, strategies, and policies to encourage more energy efficient building operations; LEED system and its international counterparts (BREAM, others); EnergyStar; prescriptive and performance based building codes; tax abatements, rebates, and other policies; effectiveness of policies and programs

Readings:
Week 13: April 17, 2018

Equality & social justice in energy efficient buildings
Exploring issues of equitable development and affordability in energy efficient and green buildings; green buildings as a “luxury” and potentially exclusionary product; benefits of energy efficiency to vulnerable populations; making energy efficient properties more accessible; examples and case studies

Readings:

Week 14: April 24, 2018

International Examples & Case Studies – Policies, Buildings, Technologies
Differences in approaches to green and energy efficient building design and construction in other countries; examples and case studies; widespread technologies; unique international policies, mandates, and building codes; comparing performance across countries

Readings:

Read the following sections:
  o “Executive Summary”
  o “Buildings”
  o SKIM any of the country summaries you are interested in

Week 15: May 1, 2018

FINAL PRESENTATIONS to SUFFOLK COUNTY and FINAL PAPERS DUE (submit one hard copy and send the file by email please)

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, Dental Medicine) and School of Medicine are required to follow their school-specific 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
Disability Support Services (DSS) Statement
If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC(Educational Communications Center) Building, Room 128, (631)632-6748. They will determine with you what accommodations, if any, 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 Disability Support Services. For procedures and information go to the following website: http://www.stonybrook.edu/ehs/fire/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.