

Course Syllabus [Spring 2017]

UP466: Energy, Planning and the Built Environment

Time: Tuesday, 5-7:30 PM

Room: 223 Temple Buell Hall (TBH)

Instructors: Brian Deal (deal@illinois.edu)
Haozhi Pan (hpan8@illinois.edu)

Credits: 4 Hours

Prerequisite: Junior standing, Senior Standing or Graduate Standing

Office hours: By appointment.

COURSE MOTIVATION

Our building stock in the state of Illinois represents approximately 40% of our total GHG emissions while demanding about 75% of our electrical production. At the University of Illinois, they play an even bigger part – buildings here represent over 80% of our GHG footprint. From another perspective, the cultural memory of this campus and more broadly of our civilization, is embedded in our buildings and physical environment. We seek to create a class on the built campus environment, especially related to sustainability and planning for carbon neutrality. We intend to use campus buildings as a learning laboratory, where students can truly engage with the material they learn on the ways we use our buildings and the ways we can improve upon them.

Clearly, any path toward carbon neutrality will need to address strategies for buildings that include vast improvements in efficiencies and approaches toward self support through renewable energy systems. Technologies for both these strategies already exist, although we have been slow to engage students in their discovery, analysis and implementation.

In this class we will learn about carbon foot printing and climate action planning with an emphasis on building energy analysis.

OBJECTIVE

The main objective of the course is to teach students about how to think about carbon from a different - energy and sustainability centric, perspective. Students in this course will learn about and subsequently apply knowledge to the study of buildings, their histories and designs, their past and present uses and place in our campus, and most prominently how they contribute to a carbon neutral future.

DELIVERY METHODS

The course is a lecture / lab type class delivered as a hybrid of face to face and online. It has been divided into 5 substantive sections:

SECTION 1	CLIMATE FRAMEWORK
SECTION 2	ENERGY BASICS
SECTION 3	UNDERSTANDING BUILDING ENERGY SYSTEMS
SECTION 4	BUILDING ENERGY CONSERVATION
SECTION 5	PLANNING IMPLICATIONS

Lectures

Each section is composed of weekly lectures and a follow up clarification lab and assignment. Lectures will be delivered on Tuesday evenings.

Labs

Labs will be delivered online with office hours on Thursday for help and assistance. Weekly assignments are a part of each lab sections. All assignments will be due Monday at noon of the week following the assigned lab. **All submittals will be made as pdf documents to: UP466Energy@gmail.com.**

Course Web Portal: <http://www.faa.learm.illinois.edu/up466/>

Major Projects

- 1. Campus building simulation and analysis using eQuest
- 2. Small Area Climate Action Plan

During the 'building energy systems' section , students will each focus on a campus building, as the focal point for applying the relevant theory examined. Students will apply energy modeling and analysis techniques learned in class to their assigned buildings, as well as: the basic elements of an energy audit, examine the building's energy consumption in detail, correlating it with how people use the spaces. Students will also discuss the planning implications of energy efficiency and the role of planners in addressing this issue. Finally, students will use their individual building evaluations to develop a small area climate action plan as part of team assignment.

OUTCOMES

This course offers a significant opportunity for students to engage urban carbon footprints. Simultaneously, it will give an important and highly marketable skill set in building energy systems modeling and analysis.

LEARNING PHILOSOPHY

The course involves lectures, reading, classroom learning, laboratory sessions, and outside applications. Some of the required reading and discussions will be led by students. Participatory learning is essential and stressed.

GRADING

- Class Participation and Attendance: 10%
- HW assignments: 25%
- Building Analysis Project: 30%
- Small Area Climate Plan Final Project: 35%

Late homework will be accepted with a reduction of 10% per day late up to 50% or, if applicable, 50% off after the answers have been distributed or discussed.

ATTENDANCE

Attendance is mandatory and an attendance sheet will be passed around in every class. Only students attending all the lectures will receive all 10 of the attendance grade. After 2 allowed excused leaves, 1 further grade point will be taken away from class attendance grade for each absence. 6 or more absence (excused or non-excused) will result in an INCOMPLETE grade for the final grade.

COURSE MATERIAL

All of the course reading materials will be available online and can be downloaded from the class web-site (<http://www.learm.faa.illinois.edu/up466/>). In addition to the readings, energy modeling software (eQuest) will be used for the course – this is available via free download and made available to all students. Please contact us if you have any trouble findings readings or using the software.

- Students teams will be provided with architectural and mechanical plans, energy use data, etc for their building evaluation project, and will be responsible for arranging site visits, etc.
- The class will have out of class arranged tours of some campus facilities in late part of the semester. Participation of campus facility visits is not compulsory, but participation can count towards bonus credits for students' final grades.

EQUIPMENT AND SOFTWARE

The course uses eQuest, a free building energy simulation tool, for building energy simulation studies. The software is downloadable at <http://www.doe2.com/equest/>. Please note that currently **eQuest only have versions that run on Windows platform**. It is students' own responsibilities to make sure that they have access to computing resources with Windows operating system and can be installed with eQuest.

SPECIAL CIRCUMSTANCES

Please communicate any expected or unexpected absences with the instructor as early as possible. Every effort will be made to work with students with unusual or unexpected obligations outside the course (family emergencies, health issues, participation in University sanctioned activities, etc.). Students with disabilities or special needs who require any accommodations to facilitate full participation and completion of the course should contact the instructor as soon as possible.

STUDENT CONDUCT

From the University Student Code, Article 1, Part 3: Students enrolling in the University assume an obligation to conduct themselves in a manner compatible with the University's function as an educational institution and suitable to members of the academic community. Students are responsible for knowing their rights and responsibilities as found in the student code at <http://www.admin.uiuc.edu/policy/code/index.html>

COURSE SCHEDULE

Date	Topic
SECTION 1 CLIMATE FRAMEWORK	
17 Jan	Lect 1: Course Intro / Energy Intro
Online	Lab 1: Climate Change and Expected Impacts
24 Jan	Lect 2: Climate Stabilization and Planning
Online	Lab 2: Carbon Inventory
SECTION 2 ENERGY BASICS	
31 Jan	Lect 3: Energy Basics
Online	Lab 3: Energy Fundamentals
7 Feb	Lect 4: Energy Generation; Grids and Renewables
Online	Lab 4: Renewable Energy Calculations
SECTION 3 UNDERSTANDING BUILDING ENERGY SYSTEMS	
14 Feb	Lect 5: Introduction to Building Energy Simulation
Online	Lab 5: eQuest Sandbox and Building Ethnography
21 Feb	Lect 6: Building Basics and Benchmarking
Online	Lab 6: Utility Bill Analysis and Parametric Runs 1
28 Feb	Lect 7: Building Envelopes
Online	Lab 7: Building Schedules / Uses and Parametric Runs 2
7 Mar	Lect 8: HVAC Systems
Online	Lab 8: eQuest Tutorial and Parametric Runs 3
14 Mar	Lect 9: Lighting and Plug Loads
Online	Lab 9: EEM Tutorial and Parametric Runs 4
21 Mar	Spring Break
SECTION 4 BUILDING ENERGY CONSERVATION	
28 Mar	Lect 10: Energy Conservation: Existing Buildings
Online	Lab 10: LEED for Existing Buildings
4 Apr	Lect 11: Net-Zero Buildings and Whole Systems Design
Online	Lab 11: Net Zero Buildings
11 Apr	Lect 12: Other Building Types and Building Codes
	Building Project Due by Midnight Monday Apr 18
SECTION 5 POLICY AND PLANNING IMPLICATIONS	
18 Apr	Lect 13: Climate Action Planning and Resources
25 Apr	Group Work and Q&A
2 May	CAP Presentations and comments
19 Apr	Small Area Climate Action Plan
13 May	
In Group	
11 May	Final Project due by 11:59pm Thursday May 11