

Classroom: 602 Lewisohn

N.B.: Items highlighted below in yellow are TBD.

Day and Time: Tuesday evenings, 6:10 pm to 8:00 pm.

Instructor: Tom Sahagian, ts3449@columbia.edu

Instructor's Office Hours: By appointment, Mondays 3:30 to 5:30 pm, 504F Lewisohn, or after class or via zoom.

Course Reader (CR) Office Hours: By appointment or announcement.

Book office hours via email either with the instructor or the CR.

Course Reader: Christopher Plum, cp3418@columbia.edu. Shortly after the due date for an assignment or exam, the CR will go over the solutions remotely with the class (see day/time via announcements on Courseworks or email).

Readings:

Each week students are assigned a set of readings in Courseworks to be completed before each class. The readings are intended to prepare students for the material covered during class and serve as reference material for assignments.

Course Books:

Sustainable Energy — Without the Hot Air, by David J.C. MacKay. The book is available for free in electronic form at <https://www.withouthotair.com/order.html>, but I strongly recommend buying the paperback edition as well.

Guide to Energy Management, by Barney L. Capehart, Wayne C. Turner and William J. Kennedy Eighth Edition, ISBN: 0-88173-765-8 or ISBN: 978-1-4987-5933-5

Note: Older editions of this book are available electronically and are suitable for use in the course

Course Objectives

Energy management is the cornerstone of any sustainability initiative. How energy is used -- and frequently, wasted -- has a significant impact on an organization's cash flow and profitability, not to mention the impact on the environment.

All sustainability managers should be able to distinguish between sustainability projects that are worth pursuing and those that are not.

This Physical Dimensions/Quantitative Analytics course will provide real-world information about energy management. Through lectures, problem sets, and readings, students will learn about energy audits, analyze the energy performance of various technologies, and evaluate the energy use and financial impacts of upgrades and operational improvements to building systems.

Pending permission from various NYC jobsites, we will also make a handful of field trips to view various energy-consuming technologies *in vivo*.

This class requires at least a basic familiarity with Microsoft Excel. Although there are no prerequisites, some basic mathematics will be necessary to complete the coursework.

If you prefer not to work with technical information and perform calculations, this class is not for you.

Class Content (HW = Homework)

- Week 01 Sept 5: Intro to Energy Efficiency Analysis **(HW)**
- Week 02 Sept 12: Energy Consumption Measurement **(HW)**
- Week 03 Sept 19: Energy Audits & Modeling; Energy Benchmarking **(HW)**
- Week 04 Sept 26: Utility Rates and Billing **(HW)**
- Week 05 Oct 3: Lighting; Ventilation **(HW)**
- Week 06 Oct 10: Properties of Air; Stack Effect; Air Handling **(HW)** **Field Trip 1**
- Week 07 Oct 17: Controls; Review material to date **(Midterm distributed – due 10/24/23)**
- Week 08 Oct 24: Space Heating and Domestic Hot Water **(HW)** **Field Trip 2**
- Week 09 Oct 31: Space Cooling; Heat Pumps **(HW)** **Field Trip 3**
- Week 10 Nov 7: Election Day – No Class
- Week 11 Nov 14: Heat Pumps; Electrification **(HW)** **Field Trip 4**
- Week 12 Nov 21: Building Envelope and Heat Transfer **(HW)**
- Week 13 Nov 28: Passive House, Solar Photovoltaics and Wind Power **(HW)**
- Week 14 Dec 5: Time Value of Money **(HW)**
- Week 15 Dec 12: Review for final; **Guest Lecture** – Carbon Capture
(Final Exam distributed – due 12/19/23)
- Week 16 Dec **XX**: Final Exam Due 12/19/23, 11:59 pm. Review finals in person or via Zoom, if desired, before holiday break on 12/23/23.

Problem Sets:

All Problems sets will assess the ability of each student to:

1. follow the analysis method at issue as presented in the lectures (partial credit will be given for partial success) and;
2. derive the answer to the problem based on the information provided.

Generally, credit for methodology is 50% and credit for the answer is 50%. However, this may vary somewhat depending on the circumstances.

You may directly email the instructor or the CR. Students must submit assignments in Excel unless otherwise directed.

An assignment submitted in other than Excel format will be given a zero. Late assignments will be given a zero unless there are extenuating circumstances (to be decided at the sole discretion of the instructor). The chances of receiving an extension will improve the sooner students bring extenuating circumstances to the instructor's attention. Last-minute and after-deadline requests are unlikely to be approved except under the most extreme circumstances.

Presentations

Depending on the size of the class, each student or pair of students will be required to make a brief (approx. 20-minute) presentation to the class on a technical topic.

Midterm and Final Exams:

The two exams will be take-home assignments. The midterm will include problems designed to ensure understanding of the key concepts covered in class up to that point.

The final will be similar, except that it will address all the material covered during the semester.

Exams are not group assignments. Students who collaborate on either exam will receive a grade of zero for that exam.

As with the problem sets, the exams will be graded on the ability of each student to:

1. follow the analysis method at issue as presented in the lectures (partial credit will be given for partial success) and;
2. derive the answer to the problem based on the information provided.

The midterm exam will be posted on 10/17/23 between 8:00 pm and 9:00 pm and will be due on 10/24/23 by 6:00 pm. Please note that questions should be submitted before 10/22/23 at 6:00 pm. Questions submitted after that time may not be addressed.

The final exam will be posted on 12/12/23 between 8:00 pm and 9:00 pm and will be due on 12/19/23 by 11:59 pm. Please note that questions should be submitted before 12/17/23 at 6:00 pm. Questions submitted after that time may not be addressed.

Questions about either exam must be limited to clarifying the language of the problems. Questions about methodology or whether or not your approach is on the right track will not be answered.

GRADING:

Weighting of Assignments:

1. Problem Sets: 40%
2. Class Participation/Class Presentations: 10%
3. Midterm: 25%
4. Final Exam: 25%

Midterm exams submitted late will receive a letter grade deduction (10 points off) for each day or part of a day they are late. Final exams not submitted by the deadline noted above will be given a zero.

If you encounter a problem submitting an assignment or exam into Courseworks, please immediately contact the Instructor, CR, or CUIT for support.

Fall 2023 Sustainability Management PS5135 section 001
ANALYSIS FOR ENERGY EFFICIENCY
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Call Number	12538
Day & Time Location	T 6:10pm-8:00pm 602 Lewisohn Hall
Points	3
Grading Mode	Standard
Approvals Required	None
Instructor	Thomas Sahagian
Type	LECTURE
Method of Instruction	In-Person