Columbia University, School of Professional Studies
Master of Science in Sustainability Management

**SUMA PS5135 Analysis for Energy Efficiency**

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**Classroom:** This course will be conducted online

**Office Hours:**

By appointment and as indicated below:

Wed 8:10-9:10pm (after class)

**Comments:**

Each week students are assigned a set of readings, to be completed prior to each lecture. These readings are intended to illuminate the material covered during lectures and to serve as reference material for assignments. Some of the readings will be highly technical.

**Course Book:**

Guide to Energy Management b Barney L. Capehart, Wayne C. Turney, William J. Kennedy – Eight Edition

ISBN: 0-88173-765-8 or ISBN: 978-1-4987-5933-5 (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. The generation, distribution, and use of energy has a profound, continuous, and global impact on natural resources, societal structure, and geopolitics. How energy is used has significant repercussions on an organizations cash flow and profitability. For these reasons, energy issues tend to be the fulcrum upon which sustainability programs hinge.

The ability to identify and articulate organizational benefits from energy savings tied to efficiency improvements and renewable energy projects is a requisite skill set for all sustainability managers.

This Physical Dimensions/Quantitative Analytics-track course will provide real-world information on energy management issues from a practitioner's perspective. Through lectures, problem sets, and readings students will learn how manage energy audits, analyze building

energy performance, and evaluate the energy use and financial impacts of potential capital and operations improvements to building systems.

The class will focus on understanding energy issues from a building owner's perspective, with discussions also examining energy issues from the perspective of utility companies, energy generators, and policy makers.

Best practice in energy management will always involve some level of complex engineering to survey existing conditions and predict energy savings from various improvement options. Sustainability managers need to understand how to manage and quality control these analyses and to translate to decision makers the opportunity they reveal. This course seeks to empower students to do that by providing an understanding of building systems and methods for quantitatively analyzing the potential benefit of various energy improvements.

This class requires an understanding of Microsoft Excel and an enthusiasm for quantitative analysis. Although there are no prerequisites for the class, an ability to do some math is required. **If you are not interested in dealing with technical information, this class is not for you.**

**Class content**

Week 01 01/13: The Argument for Efficiency

Week 02 01/20: Intro to Energy Audits and Thermodynamic Modeling

Week 03 01/27: Utility Rates, Procurement, and Billing

Week 04 02/03: Metrics and Benchmarking

Week 05 02/10: Lighting

Week 06 02/17: Commercial Air Conditioning

Week 07 02/24: Ventilation

Week 08 03/03: **NO CLASS - SPRING BREAK**

Week 09 03/10: Heating

Week 10 03/17: Building Envelope and Thermal Performance

Week 11 03/24: DHW and Cogeneration

Week 12 03/31: Economic Analysis

Week 13 04/07: Passive House (Guest Speaker)

Week 14  04/14:  Energy Policy Levers

**Assignments**

**Problem Sets**

1. Dimensional Analysis  posted 01/20,  due 01/27
2. Utility Rate Analysis  posted 01/27,  due 02/10
3. Benchmarking Review  posted 02/03,  due 02/17
4. Lighting Retrofit  posted 02/10,  due 02/17
5. HVAC Measures  posted 03/10,  due 03/24
6. Heating Systems  posted 03/17,  due 03/24
7. Hot Water  posted 03/24,  due 03/31
8. Financial Impacts  posted 03/31,  due 04/07
9. Extra Credit  posted 04/14,  due 04/21

All Problems sets will be assessed both on:

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

Credit for Methodology: 25%, Credit for Answer: 75%

**Please post all questions on Problem Sets to the Courseworks Discussion Board under the appropriate topic area. Please do the assignments in Excel, as if you make errors we can see your work and give you partial credit wherever possible.**

**Midterm**
Format TBD.

**Final Exam**

The final exam will be a take home project. It will entail an analysis of a set of energy audits from both and energy and financial perspective. Students will be asked to evaluate the finding of surveys for a set of buildings from the perspective of the sustainability manager employed by the privately-held company that owns or manages the assets in question. Students will be required to derive energy savings the result from the implementation of various efficiency improvements using information conveyed in the readings and lectures throughout the semester. Next students will be asked to perform financial analysis on the energy savings they previously determined. Analysis methodology and results will be articulated in excel spreadsheets and in memo form.

**This is not a group assignment. Students who collaborate on this exam will be given a zero.**

The final exam will be assessed both on:

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

Credit for Methodology: 50%, Credit for Answer: 50%

The project will be posted on 04/14 at 7:00pm and will be due on 04/28 by 6pm. Please note that questions should be submitted before 04/24 at 1:00pm EST. Questions submitted after that time may not be addressed.

**Method of Evaluation (Grading):**

Weighting of Assignments:

1. Midterm: 20%
2. Problem Sets: 60%
3. Final Exam: 20%

**Any problem set assignment submitted late will be given an F (50 points). Problem sets late by more than one week will receive a zero. Midterm and final exams submitted late will receive a letter grade deduction (10 points off) for each day they are late. Final exams not submitted by 05/05 will be given a zero.**