

EML6466 Industrial Energy Management

MWF Period 6 (12:50 PM – 1:40 AM)

Class Location: FLG 260

Academic Term: Fall 2023

Instructor:

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352-392-5425

Office Hours: Mondays, Wednesdays, and Fridays: 1:55 pm – 2:45 pm. Office: MAE-C 125

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

- TBD

Course Description

Fundamentals of energy management: energy-policy-development, equipment energy usage (electric and thermal), process and equipment efficiencies, analyze industrial processes and optimize their energy use. Critical evaluation of new technology for use from technical and economical perspectives. *Credits:* 3

Course Pre-Requisites / Co-Requisites

EML3100 or equivalent

Course Objectives

The course seeks to bring the student closer to the basic components of energy supply and how they can be used more efficiently in buildings and industries. The understanding of energy use and its management shows the relevance of the subject and is essential for projects management. The students will learn to evaluate the technical components of an energy analysis of new technology and its economical evaluation as well. At the end of the course, the student will be able to know and identify fundamentals of an energy efficiency program, new technologies that can be used in any installation, having the necessary guidelines and the methodology for its evaluation and implementation. It is expected that all graduate students will complete the MAE Energy Management graduate certificate, and that a fraction of them will take, and pass, a certification on energy management as is, for example, the Certified Energy Manager (CEM) from the US Association of Energy Engineers.

The objectives will be achieved through:

- In class lectures and examples
- Student completion of homework
- Student completion of class project
- Student completion of mid-term and final exams

Materials and Supply Fees

None

Required Textbooks and Software

No textbook is required for this class. Material will be taken from a variety of sources and relevant readings will be available electronically on Canvas or as otherwise noted. Relevant textbooks for the course are indicated below.

"Guide to Energy Management"; Capehart B.L., Turner W.C. and Kennedy W.J. 8th Edition. The Fairmont Press. 2016. Boca Raton, Florida. USA.

Course Schedule

Week 1: Introduction

Week 2: Policies and Incentives **HW 1 Due**
 Week 3: Energy Bills Analysis
 Week 4: Illumination, **HW 2 Due**
 Week 5: Motors and Pumps
 Week 6: HVAC & Chillers, **HW 3 Due**
 Week 7: Compressed Air Systems, **Exam 1**
 Week 8: Insulation, **HW 4 Due**
 Week 9: Boilers
 Week 10: Economic Analysis & Industrial Project Evaluation, **HW 5 Due**
 Week 11: Determination and Evaluation of Improvement Opportunities, Class Project Announced
 Week 11: Measurement tools, **Exam 2**
 Week 12: Cogeneration, **HW 6 Due**
 Week 13: Case Study and project description
 Week 13: Guest speakers from Industry and Utility
 Week 14: Class project presentations
 Week 15: Fluid mechanics of liquid metal batteries
Final Exam

Evaluation:

Homeworks: Graduate students will be assigned additional questions/problems with a higher degree of difficulty as of those assigned to undergraduate students.

Exams: In all the 3 exams of the course, graduate students will have to answer/solve 2 or 3 additional questions/problems of higher degree of difficulty, that will be in the level of the material learned in class and in their homework's additional questions/problems.

Attendance Policy, Class Expectations, and Make-Up Policy

Regular attendance is expected but attendance is not factored into the grade for the course. Contact the instructor in a timely manner to arrange any make-up work.

Excused absences must be consistent with university policies in the Graduate Catalog (<https://catalog.ufl.edu/graduate/regulations>) and require appropriate documentation. Additional information can be found here: <https://catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/>

Evaluation of Grades

Homework will be assigned weekly. There will be two in-class hour exams during the semester and a cumulative final exam.

| Assignment | Percentage of Final Grade |
|---------------|---------------------------|
| Homework | 25% |
| Participation | 5% |
| Exam 1 | 15% |
| Exam 2 | 15% |
| Final Project | 20% |
| Final Exam | 20% |

Grading Policy

| Percent | Grade | Grade Points |
|-------------|-------|--------------|
| 93.4 - 100 | A | 4.00 |
| 90.0 - 93.3 | A- | 3.67 |
| 86.7 - 89.9 | B+ | 3.33 |
| 83.4 - 86.6 | B | 3.00 |

| | | |
|-------------|----|------|
| 80.0 - 83.3 | B- | 2.67 |
| 76.7 - 79.9 | C+ | 2.33 |
| 73.4 - 76.6 | C | 2.00 |
| 70.0 - 73.3 | C- | 1.67 |
| 66.7 - 69.9 | D+ | 1.33 |
| 63.4 - 66.6 | D | 1.00 |
| 60.0 - 63.3 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

More information on UF grading policy may be found at:

<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades>

Final Group Report and Presentations: *Graduate Students* – Teams of 3 to 4 students will be requested to complete one Research Project (2 options) and an Energy Audit. Details are as follows:

- **Research Project 1:** Given the energy balance of a manufacturing facility, use optimization techniques to reduce the energy use of the plant and equipment, under some (to be provided) conditions of work. The variables will include (among others) electric energy, demand and cost, as well as electric load, utilization, and diversity factors. Students will be requested to write an optimization code and/or are expected to use tools such as Matlab for their project.
- **Research Project 2:** To propose the solution to a problem in the energy literature (to be provided) that will consider, for example, coordination and application of new technologies to industry or buildings, carbon sequestration and use issues, new sources of energy, power generation, energy policy for plants/companies/states/countries, among others.
- **Energy Audit:** The team will perform an actual energy audit to a Gainesville, FL, facility. They are tasked to provide a full energy audit report (deliverable). Students will prepare a 20-minute presentation and a 30 pages report (details of format will be provided). They will have to include: 1) process description, 2) energy usage and costs (\$/kWh, \$/kW, \$/MMBtu, etc.), 3) determine the client baseline and related metrics, 4) evaluate 3 to 5 energy management solutions, one of them being a power generation opportunity, 5) all ideas must be evaluated both technically (energy savings) and economically (cost savings, implementation costs, simple payback, return on investment, etc.), 6) provide financing opportunities available (federal, national, loans, utility, etc.), 7) provide a summary of calculations and an energy balance of the facility, 8) discussion.

Graduate/Undergraduate Co-listing: The course may be co-listed as an undergraduate/graduate course. The course differences between graduate and undergraduate are related to higher expectations particularly with respect to obtaining certificates, additional homework and exam problems, and more challenging project requirements.

Participation: Participation will be based on attendance and feedback during guest seminars, as well as providing constructive feedback and summaries of in-class and recorded project presentations.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/>. It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.ua.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their

Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Conduct Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Jennifer Nappo, Director of Human Resources, 352-392-0904, jpennacc@ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as

appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <https://counseling.ufl.edu>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

COVID-19

- You are expected to wear approved face coverings at all times during class and within buildings even if you are vaccinated.
- If you are sick, stay home and self-quarantine. Please visit the UF Health Screen, Test & Protect website about next steps, retake the questionnaire and schedule your test for no sooner than 24 hours after your symptoms began. Please call your primary care provider if you are ill and need immediate care or the UF Student Health Care Center at 352-392-1161 (or email covid@shcc.ufl.edu) to be evaluated for testing and to receive further instructions about returning to campus.
- If you are withheld from campus by the Department of Health through Screen, Test & Protect, you are not permitted to use any on campus facilities. Students attempting to attend campus activities when withheld from campus will be referred to the Dean of Students Office.
- UF Health Screen, Test & Protect offers guidance when you are sick, have been exposed to someone who has tested positive or have tested positive yourself. Visit the [UF Health Screen, Test & Protect website](#) for more information.
- Please continue to follow healthy habits, including best practices like frequent hand washing. Following these practices is our responsibility as Gators.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling; <https://career.ufl.edu>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: <https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>; <https://care.dso.ufl.edu>.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.