

THE GEORGE WASHINGTON UNIVERSITY
Environmental and Energy Management Program
EMSE 6285: Analytical Tools in Energy Management
COURSE SYLLABUS

Course Description

The Course approaches Energy Management through a wide lens as well as at different scales including countries, cities, corporations, facilities and homes. The course will provide an analytical approach to understanding energy use for different entities (i.e., governments, firms and individuals). It will provide a framework to analyze both the choices and constraints of sources and uses of energy.

The course is a practical overview of techniques and thought processes useful for people who will have decision-making responsibilities for energy systems in policy, business or engineering.

Energy management in buildings is explored in depth with an introduction to building physics, climate and comfort, and energy efficiency technologies– both in design and operations. Management of energy consuming end-uses such as lighting and HVAC using strategies including automated energy management systems, economic analysis and life cycle cost analysis as well as energy audits will be discussed.

There will be no exams. Students will be detailing a topic of interest through a research project, assignments and discussions. Project based learning through site visits, class project work, and expert guest speakers is integral to the course structure.

Learning outcomes

The course experience will result in the following outcomes for each student:

- The ability to conduct analysis for energy management
- Familiarity with energy management tools and techniques
- The ability to access a collection of resources to address energy management activities.

Grading

Main Course Assignment	Project I	45%
Short 2-week Assignment	Project II	25%
In-class Assignment	Project III	10%
Short 1-week Assignment	Project IV	10%
Class participation		10%

Textbook

No textbook is required. Internet based research will be used for class assignments.

Recommended reading:

- Guide to Energy Management, Eighth Edition, by Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, ISBN-10: 1498759335, ISBN-13: 978-1498759335

SCHEDULE AND ASSIGNMENTS

Session	Topics	Assignments
#1	<p><u>Introduction to Energy Management</u> Definition; Motivation; Background and Trends</p> <p>Intro to Project I: Main assignment</p>	<p>Intro to Project I (teams 3-4 each) Read www.withouthotair.com/ www.ted.com/talks/amory_lovins_a_50_year_plan_for_energy</p>
#2	<p><u>Macro Scale: World; Nations; Cities</u> Global energy use; Nation energy/carbon footprint-understanding areas of impact; Tools for exploring macro solutions</p> <p>Guest speaker: Ivan Jaques, Energy Sector Management Assistance Program (ESMAP) will present TRACE and how it works as an energy diagnostic tool for cities. Confirmed)</p>	
#3	<p><u>Energy Management for Corporate Strategy</u> Energy intensity of industries; corporates energy footprint and understanding areas of impact; How can companies priorities energy management?; Tools for exploring solutions</p> <p>Intro to Project II Corporate Strategy</p>	<p>Intro to Project II (teams of 2 each)</p> <p>Get familiar with the EDGE APP www.edgebuildings.com</p>
#4	<p><u>Buildings: form, climate and comfort</u> Energy use in buildings; building physics, heating and cooling; case studies; renewable energy</p>	
#5	<p><u>Buildings: Lighting</u> Standards, technologies and controls</p> <p>Project II Student presentations</p>	<p>Project II Due: Presentations (2 slides each)</p>
#6	<p><u>Economic Analysis and Life Cycle Costing</u> Financing energy efficiency</p> <p>Project 1 topic submission (5mins presentation)</p>	<p>Project 1 topic submission</p>
#7	<p><u>Energy efficient from holistic building design</u> Guest speaker: Dr. Ommid Saberi will show how energy efficiency design tools like the EDGE software can reduce energy consumption in the building.</p> <p>Project III: In-class exercise</p>	<p>Project III: In-class exercise (teams of 2) [bring laptops]</p>
#8	<p><u>Smart systems</u> Guest Speaker: Peter Morkel, Lecture on Embedded IT systems which improve resource efficiency. Examples are smart electricity meters, gas and water meters, building management systems, cold chain sensors, intelligent lighting, battery management systems etc.</p>	<p>Read: Energy surveys: A practical guide to identifying energy saving opportunities by Carbon Trust</p>

Session	Topics	Assignments
#9	<p>Guest Speaker will share their experience on using analytical tools for energy auditing including, energy modeling, building commissioning, etc.</p> <p>They will also present their latest technology collaboration called The portable Rapid Building Energy Modeler (RAPMOD) 3-D indoor mapping system transforms conventional approaches to energy analysis by automating the mapping of existing buildings and streamlining integration with energy simulation tools. (2hrs)</p>	
#10	<p><u>Energy auditing</u> Preparing for an audit; The facility inspection; Data Analysis; The audit report; Implementation</p> <p>Intro to Project IV Building Audit</p>	Intro to Project IV Building Audit
#11	<p><u>Energy auditing</u> Facility visit and interview with manager [To be confirmed]</p>	
#12	<p><u>Project I Preliminary presentation</u> Feedback with brainstorming</p>	<p>Project IV due audit report.</p> <p>Project I Preliminary presentation</p>
#13	<p><u>TBD Main Assignment</u> Group discussion with guidance and brainstorming</p>	Project I: Preparation for presentation
#14	<p><u>Main Assignment & Key Takeaways</u> (Guest panelist to be invited)</p> <p>Project I Presentations Lecture: Key takeaways</p>	Project I: Final Presentations

INSTRUCTIONS ON COURSE ASSIGNMENTS

Project I: Main assignment: Overview (45% marks)

This will be the main class assignment. Teams of 3-4 students will develop a research project; refine their ideas utilizing the class lectures and guest lectures to ask questions; brainstorm on solutions in the final weeks; and make a class presentation at the end. Project deliverables will be:

1. Project Proposal 1-2 PowerPoint Slides and 5-min presentation. Due Oct 5th
 - Description of the project
 - Why is it of interest?
 - Identification of project tasks
2. Preliminary presentation and feedback with Brainstorming (10 minutes): Nov 16th
 - Significant preliminary findings
 - Status of progress on project tasks
3. Final project presentation (15 minutes) in two-three slides: Dec 7th
 - Findings
 - Key shareable lessons

Teams may choose one of the two problems below:

- a) Can country A (choose any) technically reduce fossil fuel use by 50%? Demonstrate your response using an excel model
 - b) The energy minister of country A (choose any) has tasked you with identifying the top three strategies for improving building codes in that country which he can present at the next climate change submit. Which would you pick and why? Justify from policy, economics and energy points of view.
- OR
- c) Select a problem or current issue and present the solutions using case studies or analytics in the areas of technology, law or policy as related to energy management

Project II Corporate Strategy: (25% grade marks)

This will be a short two-week assignment. Teams of 2 students will undertake a Case Study and summarize it in two slides for the class presentation. The goal of the assignment is to identify a corporate strategy to reduce carbon footprint; identify the challenges in implementation; present possible solutions; critique the strategy.

Project III Building Design: (10% grade marks)

This assignment will be completed in the class in teams of two. The goal of the assignment will be to understand building energy efficiency and related building economics: Use a set of drawings (provided in class or bring your own) to understand a building layout; use the EDGE software to reduce predicted energy consumption of the building; note which strategies are the most effective and why.

Project IV Building Audit: (10% grade marks)

This assignment will be completed in the class in teams of two. The goal of the assignment will be to understand energy consumption of the facility we visit and provide a preliminary energy assessment and solutions to reduce energy consumption. Provide preliminary audit findings and suggestions in the form of a 2-3 page executive summary.

Note: Grades for all deliverables will be based on criteria such as substance and relevance, logic and unity, clarity, originality, and appearance. Please bring your presentations on a flash drive so we can use the class set up for projection.

University Policy on Religious Holidays

1. Students should notify faculty during the first week of the semester of their intention to be absent from class on their day(s) of religious observance.
2. Faculty should extend to these students the courtesy of absence without penalty on such occasions, including permission to make up examinations.
3. Faculty who intend to observe a religious holiday should arrange at the beginning of the semester to reschedule missed classes or to make other provisions for their course-related activities

Support for Students Outside the Classroom

Disability Support Services (DSS)

Any student who may need an accommodation based on the potential impact of a disability should contact the Disability Support Services office at 202-994-8250 in the Rome Hall, Suite 102, to establish eligibility and to coordinate reasonable accommodations. For additional information please refer to: gwired.gwu.edu/dss/

Mental Health Services 202-994-5300

The University's Mental Health Services offers 24/7 assistance and referral to address students' personal, social, career, and study skills problems. Services for students include: crisis and emergency mental health consultations confidential assessment, counseling services (individual and small group), and referrals. counselingcenter.gwu.edu/

Academic Integrity Code

Academic dishonesty is defined as cheating of any kind, including misrepresenting one's own work, taking credit for the work of others without crediting them and without appropriate authorization, and the fabrication of information. For the remainder of the code, see: studentconduct.gwu.edu/code-academic-integrity