ESM 287: ENERGY DEMAND ANALYSIS

Winter 2021

(Version: 16-Dec-2020)

INSTRUCTOR: Prof. Eric Masanet
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OFFICE HOURS: Mon 2:30-4:30pm
Online (Zoom link provided on GauchoSpace)

LECTURE: Tues Thurs 12:30-1:45pm
Online (Zoom link provide on GauchoSpace)

COURSE WEBSITE: We will utilize GauchoSpace for announcements, course documents, assignments, Zoom links, and other course resources. Registered students can access the course website on GauchoSpace here.

COURSE SUMMARY: This course will introduce students to basic concepts and quantitative approaches for understanding and analyzing societal demand for energy. In the first half of the course, students will learn core energy analysis skills and principles including working with official energy statistics, quantification of energy services, projecting demand drivers, modeling technology stock turnover, embodied energy accounting, and constructing marginal abatement/cost curves. In the second half of the course, students will apply this knowledge to construct a simplified (i.e., reduced scope) energy demand model for the United States, focusing on the buildings, transport, industrial, and food sectors. Students will also learn about major technological, behavioral, and policy strategies for transforming energy demand as a means of achieving climate objectives, and will apply their models in group projects to develop demand-sides scenarios and plans for deep decarbonization of the U.S. energy system.

GRADING:	Homework	40% (4 assignments @ 10% each)
	Final project	50%
	Participation	10%

READINGS: While there is no course textbook, we'll have several assigned readings from the following report, and we'll also refer to it frequently for modeling insights. Additional readings will be assigned throughout the course as announced on GauchoSpace.

- International Energy Agency (2017). ***Energy Technology Perspectives 2017: Catalysing Energy Technology Transformations.*** OECD, Paris. Available for free download (with registration) at: https://www.iea.org/reports/energy-technology-perspectives-2017

GROUP PROJECT: Project teams will be comprised of students from different backgrounds to facilitate interdisciplinary thinking. The project will require students to build a simplified energy demand model focused on the U.S. buildings, transport, industrial, and food sectors and use it to analyze demand-side technology, behavioral, and policy interventions for achieving climate ambitions by mid-century. A final project report will be required. Further details will be posted on GauchoSpace.

PARTICIPATION: This course will use an interactive, synchronous format in which questions, discussions, and group learning will be highly encouraged. To receive a full participation grade, students should make reasonable efforts to contribute to these conversations during the live lectures.

OFFICE HOURS: Weekly office hours will be held in virtual "open door" fashion, meaning any ESM 287 student can join the Zoom discussion at any time. This format will enable students to learn from each other's questions and facilitate cross-project learning on common modeling and analysis issues. Students who wish to discuss course questions or issues privately should email the instructor to set up an appointment outside of office hours.

ACCOMMODATION OF SPECIAL CIRCUMSTANCES: Please see the instructor for accommodation of religious beliefs, disabilities, and other special circumstances.

SCHEDULE

Week	Date	Lecture topics	Homework
1	1/5	Energy demand analysis: introduction and course overview	
	1/7	Energy services: conceptualization and quantifications	
2	1/12	Primary energy, energy carriers, and units	HW1 assigned
	1/14	Kaya, IPAT, and simplified expressions	
3	1/19	Activity projections	
	1/21	Supply-side interactions and considerations	HW1 due
4	1/26	Technology stocks and diffusion, part 1	HW2 assigned
	1/28	Technology stocks and diffusion, part 2	
5	2/2	Embodied energy accounting basics	
	2/4	Economic considerations: cost curves and learning rates	HW2 due
6	2/9	Scenarios: utility and design	HW3 assigned
	2/11	Buildings: energy demand and analysis, part 1	
7	2/16	Buildings: energy demand and analysis, part 2	
	2/18	Transport: energy demand and analysis, part 1	HW3 due
8	2/23	Transport: energy demand and analysis, part 2	HW4 assigned
	2/25	Food systems: demand and analysis	
9	3/2	Industry: energy demand and analysis, part 1	
	3/4	Industry: energy demand and analysis, part 2	HW4 due
10	3/9	Results visualization and communication	
	3/11	Wrap up	
	3/15	**Group project reports due by 3pm Pacific Time**	