540:487 – Energy Systems Modeling and Optimization

Lectures **Tuesday 5:40p -8:40p**, Room SERC-202,

Instructor: Robert Mieth

Overview: This course provides students with the knowledge and skills to perform analysis and planning tasks for energy systems. It covers aspects of the high-interest topics **renewable energy** and **energy economics**. The course centers around mathematical and computational tools for the analysis and optimal planning of electric energy systems. Students will be guided through hands-on implementation of those tools. We will use Python or Julia for these implementations. This course is designed for advanced undergraduate students with prior knowledge of the fundamentals of optimization. It is also useful for MS students who are interested in work or research in the energy domain.

Course Objectives:

- Understand the role, organization, and challenges of todays and future energy systems in the context of climate change and economic growth.
- Learn the mathematical and computational tools to model and analyze energy systems at various scales and with various objectives.
- Acquire and apply skills of energy data processing, analysis, and communication.

Tentative Schedule:

Week	Lecture Date	Topic
1	9/4	Course Introduction and Introduction to Energy Systems
2	9/9	System Tools and Decision-Making, Python Trouble-Shooting
3	9/16	Fundamentals of the Power Industry and Power Systems Operation
4	9/23	Generation Planning and Economic Dispatch
5	9/30	Renewable Energies in the Grid I
6	10/7	Renewable Energies in the Grid II
7	10/14	Introduction to Electricity Markets I
8	10/21	Introduction to Electricity Markets II
9	10/28	[Midterm]
10	11/4	Security-constrained unit commitment
11	11/11	Energy Storage
12	11/18	Power Flow I
13	11/25	[No Lecture - Thanksgiving]
14	12/2	Power Flow II
15	12/9	Demand-Side Models
16	12/16	[Final]

Organization: Lecture, Homework and Reading (10%), Project (30%), Mid-term (20%), Final (40%).

Materials: The course will not rely on a single textbook and will provide digital reading materials.

Prerequisites: Deterministic Methods in OR (540:311) or an introductory optimization course.

Questions: Contact the instructor robert.mieth@rutgers.edu with any questions that you may have.