

## Mechanical Engineering 395: Energy & Society

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### Objectives

This course explores the relationship between energy and the organization of society. We consider energy as it helps determine the geographic distribution and social organization of mankind. Particular topics vary from year to year and will include: investigating energy-intensive engineering projects such as dams and cities; how energy availability influences economic prosperity, migration and population distribution; and energy usage throughout history including the relationship between energy availability and evolution.

### Methods

Through a series of student projects, we will investigate how energy relates to economic and societal development. Projects begin with readings which report measurements or observations. Students then attempt to explain the observations through the formulation of simple quantitative models.

The course will appeal to students who enjoy a challenge.

### References

Course references will change to meet that year's particular set of projects. However, the list below suggests the combination of exposition, observation, and analysis which the projects will bring together to bear on particular issues.

*The Upside of Down: Catastrophe, Creativity and the Renewal of Civilization*, Thomas Homer-Dixon. About catastrophes, but for us, we'll use the thorough treatment of energy requirements for the construction of the Roman Coliseum in the first century.

*Energy in World History*, Vaclav Smil. An insightful treatment of the development of energy use through history. Along the way, there are precise definitions and

explanations of many of the terms useful as quantitative measures of usage and efficiency.

*Energy in Nature and Society: General Energetics of Complex Systems.* Vaclav Smil. A comprehensive and intelligent overview of energy sources and usage, mostly in the industrial age.

*Cycles of Life.* Vaclav Smil. An introduction to biospheric cycles.

*Foraging: Behavior and Ecology.* D. W. Stephens, J. S. Brown & R. C. Ydenberg, eds. Extensive descriptions showing how field work and theory need to be developed in cooperation.

*Modeling Nature: Episodes in the History of Population Ecology.* Sharon E. Kingsland. An expository introduction to the earliest mathematical models of ecology.

*Studies in Mathematical Biology, Part II: Populations and Communities.* S. A. Levin, ed. An advanced treatment of mathematical models of populations.

*Linear and Nonlinear Waves.* G. B. Whitham. A source book for the mathematics of waves. Some chapters are relevant to studying the movement of populations.

Grading will be based on two oral presentations, one descriptive and one based on the formulation of a simple mathematical model, and the written material accompanying the presentations.