Physics: Course #2:
Elementary Physics of Energy

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Introduction.

This is a course on the physics of energy. It is designed to give students a broad overview of the energy problems facing the world, but has the specific goal of encouraging quantitative thinking. It is designed to enable you to understand various issues in general terms, but the emphasis, especially in homeworks and exams will be equally on simple calculations that will help you to be **quantitative**. Therefore you should expect to have to work at the problems *outside* of class. This will be easier with the help of the TA and the sections that will emphasize problem solving.
A good idea is to form working groups where you discuss setting up of the problems, followed by independent working out of the solutions.

Syllabus: Our course will follow the book by Ristinen and Kraushaar in large part.

Energy fundamentals, units of energy, renewable vs non renewable energy
Heat Engines, thermodynamic considerations, generation of electricity and its transmission
Fossil fuels, formation of coal and fossil fuels, historical consumption rates and impending crisis
Renewable energy, solar energy and its collection, elements of solar cells and semiconductors, spectroscopy of simple atoms and molecules.
Alternative renewable energy sources: including hydropower, wind power, ocean thermal energy, tidal and biomass
Basics of nuclear energy: Nuclear reactors, fuel cycle, Fusion reactors, Energy production in the Sun.
Waste energy recovery, Fuel cells and hybrid vehicles, air pollution
Global effects, Greenhouse effect and thermodynamics.

Reading list:

The course will be at the level of the book "Energy and the environment", by R A Ristinen and J J Kraushaar (Wiley), with a somewhat greater emphasis on the physics of the various topics. The book has a good homework problems that we will address in this course. However, since the book has few equations, some supplementary book on physics might be useful to actually do the problems, in addition to the class work.

A useful supplementary book with more equations and formulas is ENERGY: Physical, Environmental, and Social impact, by Gordon J. Aubrecht (Pearson).

Another book that we will refer to is “Sustainable Energy Without Hot Air” by D. J. C. MacKay, (UIT, Cambridge). This book is available for free download and a copy can be found on my website.