"Where Stuff Comes From"
Part I: The Earth's Energy Resources

Instructor: Stephen Marshak

Week 1:

I) Introduction:

- The concept of a resource-dependent society.
- The two types of resources: *energy* vs. *material* .
- The nature of a resource, in general.
- Changing demands for resources over time; Resources sustainability issues.

II) Coal Resources:

- Geologic context of coal, and the process of coalification.
- Coal production, transport, and utilization.
- Environmental consequences of coal production and use.
- Alternative coal-based products (coal gasification; coal-bed methane).
- Carbon capture and sequestration (approaches and challenges).
- Sustainability issues related to coal.

Week 2:

III) Hydrocarbons (oil and gas):

- Geologic context of hydrocarbons.
- History of the oil industry.
- Exploring for oil (identifying traps; defining reserves).
- Conventional vs. unconventional hydrocarbon reserves.
- Production and production challenges (blowouts; "fracking")
- Transportation and refining.
- Environmental/climate consequences of hydrocarbon production and use.
- The "Age of Oil" — Reserves, sustainability, and Hubbert's curve.

Week 3:

IV) Nuclear Power:

- Radioactivity, and the origin of radioactive elements on Earth.
- Geology of uranium reserves.
- Uranium enrichment.
- Nuclear power (reactor design and function).
- Challenges of nuclear power (nuclear disasters).
- Nuclear waste.

V) Geothermal and Hydroelectric:

- sources of heat in the Earth.
- commercial geothermal energy.
- household (ambient) geothermal energy.
- the hydrologic cycle.
- river-based hydroelectric systems.
- environmental consequences of hydroelectric power.
- pumped-storage facilities.
- tidal power.

Week 4:

VI) Alternative Energy:

- the need for alternatives (carbon footprints).
- biofuels.
- wind energy.
- solar energy.
- batteries and other storage sources
- grid challenges.