Core Curriculum Scientific Inquiry 30.02: *Energy Use and Climate Change*

3 hours lecture; 3 credits

Blackboard – CUNY-Portal https://blackboard-doorway.cuny.edu/Doorway
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Monday – Thursday 9:25 – 10:40 3413N

Bulletin Description: Global energy balance as a function of the chemistry of the atmosphere and its effects on global and local climate. Climatic consequences of human energy use. The long history of climate and the relatively short history of human energy use. The socio-economic and political issues involved in attempts to project and influence future energy use and its climatic consequences.

Prerequisite: Junior standing or completion of all lower tier requirements in the same category.

Course Outline:

- Week 1 – Introduction:
  Methods of finding the "truth"; Quantitative description of data; Introduction to the issues: Recent history of the atmospheric concentrations of carbon dioxide; Recent global temperature changes; Energy consumption and the standard of living.
- Week 2 – History:
  One million years history of the climate – Tools and methods; Climate proxies; The Data.
- Week 3 – The Carbon Cycle:
  The carbon budget in air, land and the oceans; Anthropogenic Carbon.
- Week 4 – Energy, Temperature, Entropy and light.
- Week 5 – The Greenhouse effect:
  Blackbody radiation; Calculating average global temperature; Radiative Forcing; Other GHG.
- Week 6 – Light, water and the weather:
  Seasons; The Water Cycle; Energy Budget; Feedbacks; Salinity.
- Week 7 – Modeling the future:
  Climate and Weather; IPCC; Validation; Sea Level Rise; Antarctica; Tides and Gravity.
- Week 8 – Men, Energy and Technology:
  The IAPC relation; Population; GDP; Energy Intensity;
- Week 9 – Fossil fuels:
  Intensity; Limit to Growth; "Ultimate" energy reserves.

- Week 10 – Alternative energy sources:
  Primary and Secondary energy sources; Solar Energy; Nuclear Energy; Other alternative energy sources.
- Week 11 – The Economic balance:
  Cost Benefit Analysis; Lowering gas consumption; Price Elasticity; Driving forces for choice.
- Week 12 – Politics:
  Common Global Atmosphere; Governance; The Montreal Protocol; The Earth-Summit; The Kyoto Protocol; Global security vs. national security.
- Week 13 – Early Signs:
  The Arctic; Antarctica; Mountains; Biota; Health.
- Week 14 – What Can I Do?
  Personal Energy Audit; Conclusions and summary.

Common Goals Addressed by Core Course:

1. To develop the ability to think critically and creatively, to reason logically, and to reason quantitatively (*includes OARM Goals 2, 5 & 10).*

2. To acquire the tools that are required to understand and respect the natural universe. *(includes OARM Goals 5& 18)*

3. To be capable of integrating knowledge from diverse sources (*includes OARM Goal 28).*

4. To produce informed and responsible citizens. *(includes OARM Goal 8&32)*

5. To establish a foundation for life-long learning and the potential for leadership. *(includes OARM Goal 29)*

Objectives of Core Course:

1. Students will be able to understand the scientific basis and political ramifications of energy use on global climate.

2. Students will be able to differentiate between explanations that are based on the Scientific Method and explanations that are based on other belief systems.

3. Students will learn how to use data bases as an anchor of experimental observations.

4. Students will be familiar with reading and constructing graphs using logarithmic scales.

5. Students will be able to differentiate between facts, hypothesis and theory (*from OARM Goal 18).*

6. Students will learn skills that will enable them to present their work to a critical audience.

Outcomes for this Core Course:

1. Students will explain how observations support particular conclusions.

2. Student will identify questions that remain unresolved based on prior knowledge (*from OARM Goal 10).*

3. Students will use units, convert between units and work with different scales.

4. Students will read and construct graphs using logarithmic scales.

5. Students will perform simple energy audit.

6. Students will correlate global governance with physical globalization (one atmosphere).

Methods of Evaluation: There will be a midterm exam (20%) and a final exam (40%). Students will form small teams to research related global issues by using public databases such as the World Bank. Examples of projects include: Correlations of global per capita energy use with of wealth such as GDP/Capita; Global distribution of use of wood energy now and in 1960; expected populations that will be affected by see-level rise of 10'; intercontinental diffusion of CO_2. Class participation will count for 10%.

Methods of Assessment: Assessment will be based on the following mechanisms:

1. Students will be asked how a given set of observations lead to a given set of conclusion and look for observations that lead to different conclusions.

2. Students will be asked about unresolved questions based on class material and outcome from the project.

3. Students will be asked to extract information from data bases and convert between relevant units.

4. Students will "read" logarithmic scale graphs throughout the course and asked to interpret them in the examinations. Projects will require use of logarithmic-scale information and constructing logarithmic-scale graphs.

5. Students will perform simple energy audit.

6. Students will construct web pages that present their work to a critical audience. Students will use PowerPoint for oral and graphic presentations.

Bibliography:

- "*The Fork at the End of Now" – Micha Tomkiewicz – To be published*
- *Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report* http://www.ipcc.ch/

Addirional Bibliography:

- *Jared Diamond, "Collapse", Viking (2005).*
- *Frances Drake, "Global Warming", Arnold (2000).*
- *David Goodstein, "Out of Gas", W.W.Norton (2004).*
- *Bjorn Lomborg, "The Skeptical Environmentalist, Cambridge University Press (1998).*
- *Peter H. May and Ronaldo Seroa da Motta, "Pricing the Planet", Columbia University Press (1996).*

Electronic Tools:

- Extensive use of Blackboard as discussion forum and project coordination medium.

- Extensive use of on-line data bases.