THE UNIVERSITY OF BRITISH COLUMBIA

GRS 300 - Global Water and Energy Nexus (3)

Winter Term 2 2022
Tuesday and Thursday 9:00 - 10:30 AM

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Course Objective

A major concern affecting global resource systems, in addition to climate change, is our dependence on increasingly scarce available and equitable energy and water. The two are vital to terrestrial life on the planet and through their integration or nexus, provide the ecological goods and services, including food, that sustains human society. Although there is little that one can do in the short term about complexities associated with climate change, by understanding the inseparability of available energy (exergy) and water, humans can move towards a more sustainable environmental management that contributes to global equity.

Learning Objectives

Student learning objectives include an understanding of the integration of energy and water, or the nexus, from photosynthesis, the basis of terrestrial life, to the manufacturing of all material goods required and sought for by human society. All forms of available energy or exergy require water, and the two cannot be measured or managed independently. Water is a vital human need that is made available by energy either from the sun or from manufactured sources. An understanding of the nexus will provide the student with a holistic appreciation of the energy-water system and help identify actions that can contribute to more effective systems that may contribute to global equity and food security.

Evaluation

Three workshop/discussion sessions will be scheduled on topics focused on:

1. Definition and examples of systems,
2. The energy-water nexus, and
3. Description and examples of global equity.

The students will form working groups of 5-6 students, and each group will select a chair. Each student will be required to give a short presentation on the topic of the session and the chair will be asked to summarize the discussion to the class. Each student will prepare their report summarizing the outcome that will be turned in to the instructor for comment and providing a grade. An overall summary will be presented to the class by the Instructor.

Grade Distribution

Discussions and reports	25%
Participation	15%
Midterm	20%
Final	40%

COVID-19 Safety

Please wear a non-medical mask during our class meetings, for your protection and the safety and comfort of everyone else in the class. Please maintain a respectful environment. UBC Respectful Environment Statement [https://hr.ubc.ca/working-ubc/respectful-environment]

IMPORTANT: If you are feeling unwell, please DO NOT come to campus. This is to protect the health and safety of all students, staff and faculty at UBC. Please email Les before the scheduled class to inform him if you are unable to attend.

Units

1. **Introduction to the Energy-Water System**

- The integrated system,
- Global water distribution,
- Needs for services.
  - Ref: IEA (2018), Energy, water and the Sustainable Development Goals, IEA, Paris https://www.iea.org/reports/energy-water-and-the-sustainable-development-goals

2. **The Basis for Sustainability**

- Human needs and rights - UN. Declaration,
- Equity,
- Global water crises,
- Contamination.
- Remediation
  - Ref: https://www.un.org/waterforlifedecade/water_and_energy.shtml

3. **Energy, Water & Climate Change**

- Role of the oceans,
- Dynamics and extremes in temperature and precipitation
- Adaptation to shifts in hydrological regimes.
    - Ref: https://youtu.be/ZhuCK2oTd9c

4. **Systems and Adaptation**

- The water system
- Complex systems,
- Human impacts – Panarchy
    - Ref: http://environment-ecology.com/general-systems-theory/137-what-is-systems-theory.html

5. **Water - Unique Properties**

- Factors affecting water distribution,
- Chemical,
- Physical- heat capacity,
- Control of Earth's energy balance

6. Energy-Water Nexus

- Inseparable,
- Components, interactions and emergent properties,
- Innovations,
- Thermodynamics

7. **Ecological/ Environmental Productivity**

- Human relations,
- Energy evolution,
- Why fossil energy?
- Thermodynamics,
- Alternate sources

8. **Energy return on energy invested (EROEI)**

- The theoretical framework,
- EROEI of energy sources,
- Comparison of energy sources,
- Why fossil/nuclear?

9. **Systems Analysis**

- Approaches,
- Facts and beliefs,
- Models for communication,
- Critical reading/thinking

10. **The Nexus**

- Sustainability?
- Energy/water -> food security,
- Resources conflicts,
- Optimism

***Possible Futures Student Workshop – To be discussed in class**

References

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