Narrative for the 102 lab

The lab will explore the IPAT relationship and use the scientific method to evaluate technological solutions to environmental problems.

The main concepts that are presented in the lab are usually introduced first in the lecture section, but that is not always possible.

The lab session will build an understanding of water and energy consumption. There will be weekly worksheets that guide students through the process of collecting and analyzing information. There will be three major assignments (energy and water audit, measuring fuel consumption, LCA on an appropriate scale water and/or energy system for a household or community). Each of these will be presented in class and peer-reviewed constructively. Students will submit a final paper on their design.

Grading

10 weeks participation – 5 pts each week = 50 points

3 assignments – 10 pts each = 30 points

1 final paper – 20 pts =20 points

3 10 point quizzes on D2L =30 points

Week 1:

* Presentation
  + IPAT and define each term
  + Affluence = consumption, use of resources
  + Examples of consumption and magnitude
    - Water
    - energy
  + Consumption varies by region and economy
  + Renewable sources vs. non-renewable or “mined” resources
  + Impact of consumption – side effects
    - Water
    - Energy
* Discussion
  + Focus of the lab is to examine impact and ways technology can help people get the appropriate amount of water and energy with the least impact.
  + Discuss harmful impact and think of ways it can be turned into benefits. For example: Eating local reduces transportation costs and processing and replaces that with local farms and fresh food.
* Exercise – explain in class:
  + Ecological footprint as a conceptual indicator of the impact
  + Of your personal use
  + But, how much responsibility do you have for overall water and/or energy consumption in the USA?
* Assignment – do the worksheet:
  + compare to averages in the Western World and another (videos and material from class) developing country
  + Comparison to other countries – specific information

Week 2:

* Presentation: Scientific evaluation
  + Science
    - Rigorous – follow all leads, stopping rule is that you find the answer
    - Repeatable
    - Shared for peer review
  + Scientific method
    - Gather information
    - Formulate questions
    - Identify testable hypotheses
      * Measured
      * Falsifiable
    - Measure and report results
    - Peer review with suggestions for further work
  + Evaluation
    - Are we doing the right thing?
    - Are we meeting our objectives?
    - Objects/scientific-evaluation.html
* Presentation: Population growth models
  + Human population is not controlled by a “carrying capacity”
* Description of energy and water “footprints” as audits
* Discussion:
  + What were the major factors that changed your footprint?
  + How could these “footprints” be used by individuals, businesses, communities, or regions?
  + What are some of the questions that you have about the footprint methodology?
  + Take a step back from that big picture to individual use and audits.
* Assignment #1: energy and water audits due in Week 4

Week 3:

* Energy and conversion between different units (powerpoint)
* Different systems for measuring mass and energy
  + “English” –
  + Metric (mks, mgs)
* Discussion: Energy is illusive – hard to conceptualize some of these units
  + For example – what would you pay to get across the city (MAX, bus, Car2Go, taxi, Uber (just kidding))
  + As an post-industrial, energy-driven society, it is important to be able to convert energy units
  + What would you pay for a gallon of gas or a charged battery in a hybrid?
  + What would you pay for 1 gallon of oil, cord of wood, 100 kWhr of electricity to heat your house?
  + What exactly are you paying for?
    - Energy (such as kWhr)
    - Ability to store and control that (electricity, fossil fuels, wood)
* Assign Conversion worksheet

Week 4:

* Share energy and water audits
  + Peer review
    - comparison of results
    - explain differences
    - generate hypotheses and tests for differences that you can’t directly explain
* introductory discussion of linkages between water and energy
  + concepts
  + link back to footprint calculator
* Energy technology – (presentation)
  + Appropriate technological solutions
  + Information necessary
  + Rigorous science to eliminate unexpected side effects
  + Innovation requires social support
  + Barriers to implementation (examples)
* Assignments:
  + Worksheet: estimate the amount of wood or propane it will take to boil 2 liters of water
  + Explain lab for week 5 and assign groups so that they can be prepared to start right when they get to lab
  + Online quiz over energy units and energy technologies
    - Energy and work definitions
    - Examples of energy units
    - Simple conversion
    - Energy technologies - recognition

Week 5:

* Assignment #2: measure amount of fuel used to boil water
  + In-class
    - Hotplate
    - Gas camping stove
    - Twig burner
    - “Provecho” stove
    - open grill
  + data
    - wood or fuel weight
    - water temperature and volume
    - specifics of the geometry of the heating rig
    - weather conditions
* (online –

Week 6:

* Share results from cooking assignment
  + Same discussion and comparison as week 4
* Embedded energy and water presentation
  + Intro to LCA

Week 7:

* Introduce problem of water and energy in developing countries
  + Impact on individual people’s lives
  + Broader context
    - Social
    - Environmental
    - Economic
* Potential solutions to one or more of these problems
* Information demand problem
  + Need to know
* Design considerations
  + Robust design
  + Construction
  + Cost
  + Operation
  + Actual impact on individuals and community – monitoring
  + Unintended consequences
* LCA – light
* Worksheet in class
* Assignment #3: Design appropriate scale (due week 9)
  + Water and energy system
  + Specific use
  + General context (community description)
  + All components
  + Evaluation
    - Technical specs
    - Expected benefits
    - How you would monitor these
  + Diagrams and pictures

Week 8:

* Work session on project
* Sources of information
* On-line discussion

Week 9:

* Presentations with serious peer review
* Specific changes to be made stated in positive way
  + Looking up information that could help that person’s presentation
* Quality of peer review comments will count

Week 10:

* Recap on scientific evaluation of appropriate scale projects
  + Science
  + Evaluation
* Implications of these
  + Developing countries
  + Personal use (remote sites)
  + Neighborhood sustainability
  + Emergency and disaster response
* Final paper due -