

Final Exam

Thursday, June 12, 11:30 am - 2:30 pm, open note.

Please write your name and student ID number on your blue book.

1. [30 points] Answer 6 of the following 7 questions:
 - a. Define sustainable development.
 - b. What characterizes all LEED certified buildings? Name three features that they may include.
 - c. What did Malthus predict, and why has his prediction not come true?
 - d. What is the triple bottom line (the 3Es)?
 - e. What makes IPCC evaluations of global warming credible?
 - f. Identify two ways in which energy prices and (raw) food prices are linked.
 - g. Why might a farmer support agriculture to urban water transfer?

2. [35 points] Write an essay on 1 of the following 2 topics:
 - a. Jeffrey Ball posted an item to *The Wall Street Journal* blog Environmental Capital (June 2, 2008) commenting on the Senate debate over the Lieberman-Warner bill, which was intended to cap US greenhouse gas emissions. He wrote,

This fight is brown vs. green, not red vs. blue. “Where you stand depends on where you sit,” goes an old saw about politics. That’s particularly true about the politics of energy and the environment, where allegiances are less about party affiliation and more about regional fuel supplies.

The bill was killed in debate, but could be revived next year, after the general election. In a well-crafted essay, explain what Ball means. Who are the stakeholders in the environmental debate, and what positions are they likely to advocate?
 - b. One of our guest lecturers, Prof. Richard Somerville, was one of the originators of the 2007 Bali Climate Declaration. The declaration begins with some background information on global warming and then states,

The next round of focused negotiations for a new global climate treaty (within the 1992 UNFCCC process) needs to begin in December 2007 and be completed by 2009. The prime goal of this new regime must be to limit global warming to no more than 2°C above the pre-industrial temperature, a limit that has already been formally adopted by the European Union and a number of other countries.

Based on current scientific understanding, this requires that global greenhouse gas emissions need to be reduced by at least 50% below their 1990 levels by the year 2050. In the long run, greenhouse gas concentrations need to be stabilised at a level well below 450 ppm (parts per million;

measured in CO₂-equivalent concentration). In order to stay below 2°C, global emissions must peak and decline in the next 10 to 15 years, so there is no time to lose.

As scientists, we urge the negotiators to reach an agreement that takes these targets as a minimum requirement for a fair and effective global climate agreement.

In a well structured essay, explain how developed and developing countries might be expected to respond to the Bali Climate Declaration. What issues are likely to be at stake in the negotiations? What are likely points of agreement and points of contention?

3. [35 points] Write an essay on 1 of the following 2 topics:

- a. Scott Adams, creator of Dilbert, posted the following statement on his blog (21 December 2007):

When I was researching green technology, I was disappointed to find out that no amount of solar panels can get you off the power grid. You also need a way to store the power for night use, and that technology is not yet economical or convenient.

There's something cool about the thought of being totally off the power grid. It's a psychological thing. I could rationalize being off the grid by saying it would come in handy if the rest of the world runs out of energy. But realistically, the big worry in that case wouldn't be powering my iPod so much as not getting eaten by cannibals.

This week I saw some stories that reactivate my fantasy of being off the power grid for no practical reason whatsoever. First, you will soon be able to have your own nuclear reactor for your house.

[From http://dilbertblog.typepad.com/the_dilbert_blog/2007/12/off-the-grid.html]

Adams went on to link to the following news item:

Toshiba has developed a new class of micro size Nuclear Reactors that is designed to power individual apartment buildings or city blocks. The new reactor, which is only 20 feet by 6 feet, could change everything for small remote communities, small businesses or even a group of neighbors who are fed up with the power companies and want more control over their energy needs.

The 200 kilowatt Toshiba designed reactor is engineered to be fail-safe and totally automatic and will not overheat. Unlike traditional nuclear reactors the new micro reactor uses no control rods to initiate the reaction. The new revolutionary technology uses reservoirs of liquid lithium-6, an isotope that is effective at absorbing neutrons. The Lithium-6

reservoirs are connected to a vertical tube that fits into the reactor core. The whole process is self sustaining and can last for up to 40 years, producing electricity for only 5 cents per kilowatt hour, about half the cost of grid energy.

Toshiba expects to install the first reactor in Japan in 2008 and to begin marketing the new system in Europe and America in 2009. [From <http://www.nextenergynews.com/news1/next-energy-news-toshiba-micro-nuclear-12.17b.html>]

Write an essay explaining how you would evaluate the Toshiba technology from a life cycle assessment stand point. Please also consider the perspective of a variety of potential stakeholders, including neighbors, utility companies, and individuals who desire to be off the regular power grid.

- b. A recent *New York Times* article discussed carbon sequestration:

For years, scientists have had a straightforward idea for taming global warming. They want to take the carbon dioxide that spews from coal-burning power plants and pump it back into the ground.

President Bush is for it, and indeed has spent years talking up the virtues of clean coal. All three candidates to succeed him favor the approach. So do many other members of Congress. Coal companies are for it. Many environmentalists favor it. Utility executives are practically begging for the technology.

But it has become clear in recent months that the nation's effort to develop the technique is lagging badly.

In January, the government canceled its support for what was supposed to be a showcase project, a plant at a carefully chosen site in Illinois where there was coal, access to the power grid, and soil underfoot that backers said could hold the carbon dioxide for eons....

Drawing on your knowledge of the topic, explain why environmental groups and utility executives favor carbon sequestration? Why might some other groups oppose it? What are advantages and disadvantages of carbon sequestration?