Homework 2  
due Tuesday March 6  
Economics of the Environment and Natural Resources/Economics of Sustainability  
K Foster, CCNY, Spring 2012

You are encouraged to form study groups to work on these problems. However each student must hand in a separate assignment: the group can work together to discuss the papers and comment on drafts, but each study group member must write it up herself/himself. When emailing assignments, please include your name and the assignment number as part of the filename.

Please write the names of your study group members at the beginning of your homework to acknowledge their contributions.

1. Write a short essay (about 200 words) on one of the geoengineering topics discussed by Ken Caldeira that you found particularly interesting (which might reflect a bit of additional research on your part, particularly if you couldn't be there). You need not agree with him, of course! Each person should write their own essay although you should have someone in your study group proofread.

2. Consider the market for a product with an output that pollutes the air. The industry's Supply curve (only including private internal costs) can be represented as \( Q_S = 3P_S \). The demand can be approximated as \( Q_D = 100 - 5P_D \). The industry's marginal external costs from pollution occur as \( MEC = 0.5Q - 10 \) whenever \( Q \), the quantity produced, is greater than 10.
   a. What is the privately chosen equilibrium quantity and price, when neither demanders nor suppliers take account of external costs?
   b. What is the MSC, the marginal social cost (the vertical sum of MC and MEC)?
   c. What is the social optimum level of production of this good? What is the deadweight loss created by a lack of government action?
   d. Suppose the government introduced a tax (per unit of output) to try to move closer to optimum. (Recall that this means that \( P_D = P_S + \text{Tax} \).) What tax would reduce DWL the most?
   e. If the government instead restricted the level of output through regulation, what regulation would be set?
   f. If demand for this product suddenly rose so \( Q_D = 12 - 2P_D \), what would be the effects of the tax or regulation that was imposed above? Is there DWL now?

3. Consider fracking, which drills for natural gas but pollutes water supplies. A particular well site being considered would impact drinking water supplies over an area of 100 [assume this is in thousands of acres]. The impacted area could be reduced at a cost [measured in tens of thousands of dollars]; denote the area cleaned up as \( x \) [thousands of acres] then the cost of avoidance is \( 3x \). The drinking water facility could find new sources of water at cost \( 2y \), [\( y \) in thousands of acres to be newly sourced]. So for
example if the well site reduces impact by 10 then it pays $3 \times 10$ while the drinking water facility pays $2 \times 90$.

a. Absent any regulation or coordination, how much cleaning would be done by the frackers? What would be the costs to each side?

b. What would be the optimal amount of impact reduction and cleanup, chosen by a social planner who weighted the costs of both parties equally?

c. What would the Coase Theorem suggest would be the outcome, if regulations demanded that the frackers pay the cost of drinking water sourcing? If regulations gave the frackers free disposal?

d. If instead of a single drinking water facility, there were 1000 separate wells, what would be the likely outcome, from a Coase perspective?

e. What if the fracker’s cost of avoidance were $3x + \frac{1}{4}x^2$?

f. The value of the natural gas has not yet been mentioned: how would softening prices affect the analysis? (For example see these two articles, http://www.theoildrum.com/node/8900 and http://www.theoildrum.com/node/8914.)