Homework 3 Possible Solutions

Economics of the Environment and Natural Resources/Economics of Sustainability K Foster, CCNY, Spring 2012

- 1. Write a response to the webinar presentation on "Economic Aspects of Sustainability." You might read some of the additional material I present on Blackboard (Course Documents \ Sustainability) or dig into the bibliographies of those articles. What ought to be the considerations of a society for sustainability?
- 2. Consider regulations of an industry with 2 sorts of plants, designated (with a complete failure of imagination) as type 1 and type 2. Costs for both types of plant are $c(y) = 10 2y + 0.3y^2$. Type 1 plants are dirtier and produce emissions at a rate of $e_1 = 0.2y_1 + 0.1y_1^2$; type 2 plants just $e_2 = 0.1y_2$. Each unit of output, y, is sold for a price
 - of 4.
 - a. Create a table of costs, revenue, and profit for different levels of output (integer values to 20 is sufficient, an easy spreadsheet table). Assuming that emissions are free, what level of output would each plant type choose?

The spreadsheet is attached; ignoring emissions, the optimal choice of output is 10 for each plant.

b. Suppose regulations capped plant emissions at 1 – what level of output would the plants choose? Is this efficient – is there a way to produce the same output with fewer emissions?

Plants of type 2 would still make y=10; plants of type 1 would be limited to 2.32 (solve the quadratic formula). This is not efficient; for example plant 1 could reduce output to 1.32, which would reduce their emissions by 0.54, while plant 2 could increase output by 1, which would increase emissions by only 0.1.

- Suppose emissions were taxed at a rate of \$1 per unit of emission what would be the new amounts of output chosen at each plant?
 If emissions were taxed at a rate of 1, then costs would be c(y) + 1*e(y). This is in the worksheet. Now firms of type 1 would produce just 7, while firms of type 2 would make 10.
- d. (extra for Eco students) With a bit of calculus, find the optimal choices for any given emission tax. What is the marginal amount that a plant would be willing to pay for the last unit of emission? Without regulation, firms set MC=P so -2+0.6y = 4 so y*=10. With a tax of t per unit of emission, the optimal choice for firms of type 1, is given from c(y) – t*e(y), so $10-2y_1+0.3y_1^2+t[0.2y_1+0.1y_1^2] = 10+(0.2t-2)y_1+(0.1t+0.3)y_1^2$ so MC = 0.2t-2+(0.2t+0.6)y. Set MC=P so 0.2t-2+(0.2t+0.6)y = 4,

$$y = \frac{6 - 0.2t}{0.2t + 0.6}$$
 so with t=1, this is 5.8/.8 = 7.25.

The optimal choice for firms of type 2 is given from c(y) – t*e(y) so $10-2y_2+0.3y_2^2+0.1ty_2$. MC = $(0.1t-2)+0.6y_2$ so set MC=p and solve, $(0.1t-2)+0.6y_2 = 4$, $y_2 = \frac{6-0.1t}{0.6}$ so with t=1 this is 9.833.

3. Choose an academic paper on the topic of your final project (coordinate with your group). Write a short overview of this paper (250 words).