

# ECN 275/375 Environmental and natural resource economics

## Exercise set 6

### Exercise 6.1 – The “downstream problem” (and an extension)

There is a polluting factory in a river that leads to pollution downstream. The polluting factory creates no externalities where it is located. Current emissions and damages from these emissions are as follows:

- At the site of origin: emissions  $M_0 = 100$ , marginal damages  $MD_0 = 0$
- At the first site downstream: emissions reaching site  $M_1 = 0.6 M_0$ , where  $M_0$  is emissions at the pollution site.
- At second site downstream:  $M_2 = 0.3 M_0$

The marginal abatement cost function is:  $MAC_0(M_0) = 50 - \frac{M_0}{2}$ , where the current.

It is assumed to be far more costly to clean the polluted river water downstream than to reduce emissions at the site.

At both sites the marginal damage function is the same i.e.,  $MD_i(M_i) = M_i \forall i=1,2$ , where  $M_i$  is the amount of pollution reaching site  $i$ .

- (a) The environmental protection agency (EPA) has decided that the maximum allowed damages at any site is 40. How much are emissions needed to be reduced at the polluting site?
- (b) After some consideration, the EPA has figured out that the standard in (a) may not be optimal. How can the EPA find the optimal pollution level, i.e., to maximize the welfare in society? And if so, what is the optimal pollution level?
- (c) Suppose that the two downstream locations are located in two other countries than where the polluting site is located. Why is it difficult to reach the optimal solution in (b)?

### Exercise 6.2 – Different marginal damages at different locations (2)

In a country there are two rivers, one with a highly valuable fishery, and the other without any extra environmental value (besides the ordinary). Located by each of the rivers, there are three paper mills, each mill producing a special quality paper for a limited (niche) market, using similar production technologies. Together the mills cover a large share of the market supply of this quality paper.

While being concerned about the environment, the government also worries about international competitiveness. Hence, it has hired in a private consulting firm, Quick & Dirty Ltd.

The main points in the recommendations of Quick & Dirty are:

- making a joint market for tradable emission permits in the two rivers, and
- grandfathering out permits to firms of approximately 50% of current emissions.

As an external expert reviewer comment on the recommendations of Quick & Dirty.

- (a) What specific problems, if any, do you see with Quick & Dirty's recommendations? Justify your answer.
- (b) What policy changes, if any, would you suggest? Justify your answer.