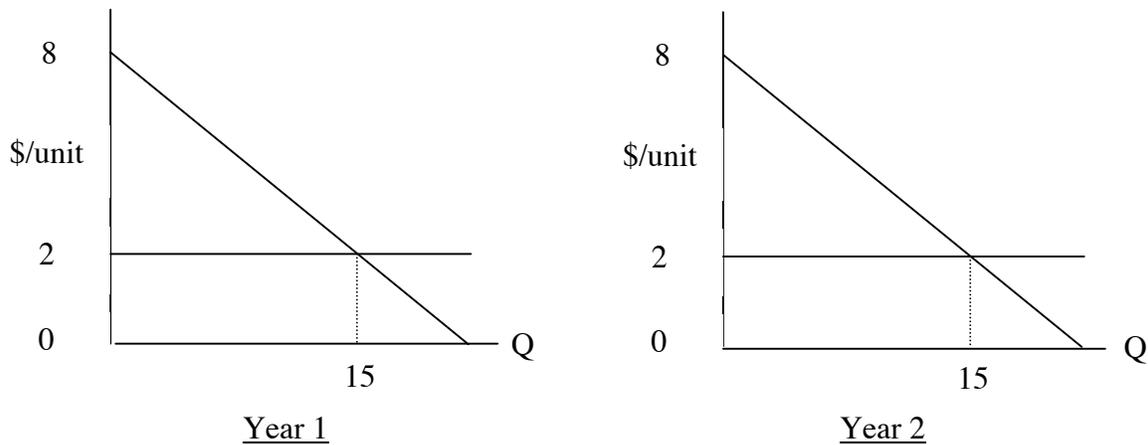


ENVR 252
Dr. Characklis

- (1) When is it appropriate to evaluate a situation in dynamic terms? What two conditions describe a state of “dynamic efficiency”?
- (2) The consumption of an infinitely divisible, nonrenewable resource (suppose it is coal) is to be allocated over two periods (year 1, year 2). Demand in both years is described by the function: $P = 8 - (0.4 * Q)$. The marginal cost of extracting (i.e. mining, refining, delivering) the coal is constant: $MC = \$2/\text{unit}$.

See diagrams below.



- (a) If the available supply of coal (the amount in the ground) is limited to 35 units, what will be the equilibrium price and the quantity consumed in each year?

Now, suppose that the two year supply of coal is capped at 20 units. A market for the right to extract coal is held in Year 1 wherein the rights to the entire supply are to be sold (Note: once you purchase the right, you must still pay to extract the coal). Units of coal will either be consumed at the time of purchase (Year 1) or exactly one year later (Year 2). Assume that consumers allocate the units of coal between years 1 and 2 in a manner that maximizes the present value of net benefits, and that the discount rate for all consumers is 10%.

- (b) Calculate the consumption of coal allocated to years 1 and 2, respectively.
- (c) Calculate the market clearing price for the rights to extract the coal. There is another name for this value, what is it?
- (d) Calculate the present value of net benefits (PVNB) under the conditions described in steps (b) and (c).

- (e) Suppose that instead of being allocated through a market, coal were to be allocated by a governmental agency. Having poor information, the agency issues a ruling requiring that 15 units of coal be allocated for year 1 and 5 units for year 2. What is the change in PVNB relative to that calculated in (c).
- (f) Demonstrate (either numerically or analytically) that (c) is, in fact, the maximum level of PVNB that can be obtained from 20 units of coal over the two time periods.
- (g) Suppose that the 20 units were allocated over three years. What allocation of coal to years 1, 2, and 3 will maximize PVNB? What is the market clearing price?