

Assignment 5

EE 553 Power System Economics

Due May 10th, 2017 at 8pm. Email to ywang11@uw.edu

Problem 1. The demand curve, in terms of quantity q (kWh) brought by a consumer, in a given period, as a function of price p (¢) is given by the following:

$$p = -0.01q + 5.$$

1. Suppose the price is $p = 3.5\text{¢}/kWh$. Find the total payment made by the consumer and the demand surplus.
2. If the price is increased by 10%, find the reduction in consumption and the new payment.
3. Now suppose the **cost** of production is given by

$$C = 0.0075q^2 + 1.3q.$$

Find the marginal cost (the supply curve) and find the equilibrium price and demand at this price.

4. At the equilibrium point, find the demand surplus, the *net revenue (profit)* of the supplier, and the social welfare.

Problem 2. Consider a system of a physical generator, a physical load, and two virtual traders (speculators). They agree on the following forward contract:

Seller/Buyer	Amount (MW)	price (\$/MW)
Gen/Trader 1	1 MW	45
Gen/Trader 2	2 MW	55
Gen/Load	1 MW	48
Trader 2/Trader 1	1 MW	60
Trader 1/Load	2 MW	50

At the time of delivery, the spot market has a price of $\$50/MW$. Find the total revenue of the generator, the traders, and the total payment of the load.

Problem 3. A regional operator runs the following electricity market. The total cost of energy is:

$$C = 1.5q^2 + 100q$$

where q is in MWh and C is in \$. The demand curve is:

$$p = -20q + 4000.$$

1. Find the supply curve in terms of price and quantity.
2. Calculate the equilibrium clearing price and quantity.
3. Find the consumers' surplus and the producers surplus.
4. Now suppose the operator wants to impose a tax of \$20/MWh. This is accomplished by building it into the supply function: raising supply curve by \$20/MWh. Find the new supply function and the new equilibrium point. How much revenue would it raise?