

July 3, 2015

ENERGY ECONOMICS

Master of Science in Energy Engineering

Duration: 2 hours and 30 minutes

During the test students are not allowed to use class notes or textbooks or to leave the classroom

Mark the exam folder with your Name, Last Name and Politecnico di Milano Id. Number

At the end of the test hand over only the exam folder

Name	
Last Name	
Id. Number	

Instructions and grading system

Read the questions carefully and provide answers to all the points raised in each question.

It is important to use a correct and appropriate terminology for all economic and technical terms.

Remember to define all variables and parameters used in your answers.

A full score will be awarded only if the answer is correct and complete.

A partial score will be awarded only if the partial response, albeit incomplete, does not contain any errors.

1) A firm in a competitive market has a cost function given by $TC = 10y^2 + 1000$. What is its supply curve? Discuss your answer for market prices lower than 200. Illustrate your answer with a graph where you depict the firm supply curve, average costs and average variable costs. (4 points)

2) A profit maximizing monopolist is operating at an output level where $|\varepsilon| > 1$. The government imposes an environmental tax on the quantity produced, equal to 10 € per unit of output. If the demand curve facing the monopolist is linear, how much does the price rise? For simplicity assume that the monopolist has constant marginal costs. Illustrate your answer with a graph. (4 points)

3) You observe that there is only one firm in a market. Can you always conclude that there will be monopoly inefficiencies? Briefly motivate your answer. (2 point)

4) In a multiproduct context, a fully informed regulator is considering to set a uniform price per unit of output supplied by the firm. These prices will depart from the products' marginal costs by a common mark-up consistent with meeting the firm's budget constraint. Can the regulator do better from a social perspective? Illustrate your answer with a graph. (2 points)

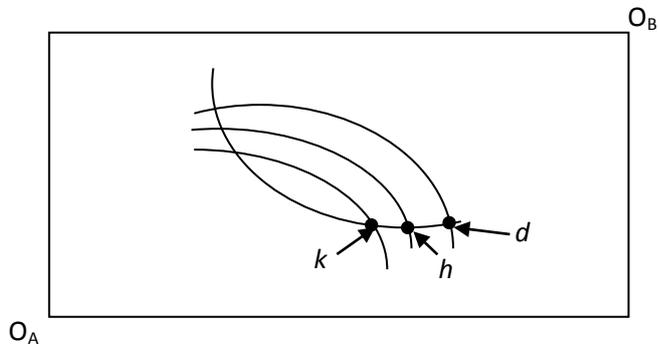
5) Provide a brief but clear characterization of the nature of a regulator's information disadvantages. (2 points)

6) Consider Cost of Service regulation in practice. A single asset firm incurs an investment cost K_0 at time $t=0$. Assume that the accounting life of the asset is equal to N years. How is the Regulatory Asset Base (RAB) normally calculated? Give also the formulation for the firm's total revenue requirement in year t (2 points)

7) Briefly list the main uses of natural gas in the economy, specifying the major natural gas demand's segments, characteristics and determinants. (2 points)

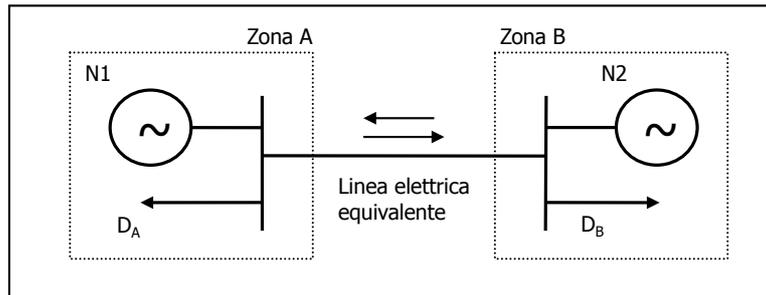
8) Explain the difference between auction and continuous auction (or continuous negotiation), providing one example for each system within the Italian natural gas market. (2 points)

9) Consider the pure exchange economy represented in the Edgeworth box below, where A and B are two agents of this economy and O_A and O_B represent their respective point of origin. Allocations h and k represent a Pareto improvement with respect to the initial allocation d ; however they are not Pareto-efficient. Is this statement true or false? Motivate your answer. (2 points)



10) Consider a steel company that pollutes air and thus generates a negative externality for the locals. If the Government imposes a tax on the steel produced by the firm, the output produced will be socially efficient? Beside taxes, is there another way to correct for externalities adopting an incentive-based approach? Describe it very briefly. How does this differ from a tax? (4 points)

11) Consider a zonal market with PUN, structured as in the figure below. Using the data provided, respond to the 3 questions indicated on page 10.



Total demand in Zone A: 6,500 MW

Total demand in Zone B: 4,500 MW

If not engaged in a bilateral contract, demand in both Zones is offered on the Power Exchange at 100 €/MWh

Generator N1: total capacity 3,000 MW, of which

1,000 MW hydro capacity, bid on the Power Exchange at 10 €/MWh

500 MW thermal capacity, bid on the Power Exchange at 80 €/MWh

1,500 MW bilateral contract with consumer in Zone B (1)

Generator N2: total thermal capacity 9,000 MW, of which

3,800 MW bid on the Power Exchange at 20 €/MWh

4,000 MW bid on the Power Exchange at 60 €/MWh

500 MW bilateral contract with consumer in Zone B (2)

700 MW bilateral contract with consumer in Zone A (3)

N.B. In case of ambiguity fix the equilibrium price at the level of the most expensive generator that is dispatched.

A) Infinite transmission limit. Find the equilibrium price on the Power Exchange, the accepted quantities for all market operators (generators and demand). *(1 point)*

B) Transmission limit equal to 3,500 MW. Find the equilibrium price(s) on the Power Exchange and the accepted quantities for all market operators (generators and demand). Calculate the congestion costs. *(1.5 points)*

C) Calculate the congestion rent for case (B) above. Provide all the details of the calculation (i.e. do not use the short formula) *(1.5 points)*

Additional space to complete answers (please refer to the exact question you are completing here)