Exam Energy Economics IR June 2011-06-05

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Open book exam. You have 3 hours to answer these questions. Limit the length of your answers. Good luck!

1. Until last year, it was assumed that in Europe we would be in equilibrium on the gas market, where Russia is the dominant supplier. The availability of cheap non-conventional gas in North-America and China could potentially change the market equilibrium in the EU.
   You are asked to evaluate the effect of non-conventional gas on the EU market. Assume first that gas is a non-exhaustible resource, and use this data:

(Q= quantity in billion m³, p= price in million €/ billion m³)

Demand function for gas in EU: Q=1280 – 1.6 p
Competitive supply of gas in EU: QC= 200+0.5 p
Marginal cost Russian gas = 100

Non-conventional gas could be delivered in unlimited quantity to the EU at a price of 250.

a) Calculate the equilibrium on the EU market without non-conventional gas, where Russia is the dominant supplier. Give price and quantity.

Max 15 lines

Dominant supplier Russia (R) has demand function for its gas:
QR=(1280-200)-1.6p-0.5p
=1080-2.1 p

Profit maximization for Russia:
Max πR=(1080-2.1p)(p-100)
FOC gives: p=304.76
QC=200+0.5(304.76) = 152.38
Q= 1280-1.6p = 792.38
QR= Q – 200-152.38 = 440
πR=(1080-2.1p)(p-100)= (440)(204.76)=90 097.4

b) Calculate the equilibrium on the EU-market with non-conventional gas, where Russia is the dominant supplier. Give price and quantity.

Max 15 lines

Russia can never ask more than 250 €. Assume that Russia asks just below 250 for its gas. Then the new equilibrium is:

p^*= 250
Q^*= 880
QC^*=200+125=325
QR^*= 880 – 325 = 555
πR^*=555(250-100) = 83250

c) What does this entail for the reliability/security of gas supply in the EU? And how would you address this issue?

Max 8 lines

Share of gas supply from Russia in EU has increased: 555/880 or 63% > 440/792 (or 56%).
The reason is that Russia does not allow the new supplier to enter the market, by supplying gas at a price just below 250.

2. Now assume that both conventional and non-conventional gas are exhaustible resources. Assume that the quantity of non-conventional gas, easily extracted in North America and China, is rather large. It is estimated that this would double the worldwide available gas reserves in 20 to 30 years from now. Some people claim that this has no impact on the EU market, as there is a dominant player who determines all outcomes. Others state that there could be an influence. The European Commissioner for Energy asks for your advice:

   a) What is the effect on the new gas contracts that are being made now in Europe? (max 10 lines)

The gas market is a regional market, but when prices are high enough, the EU market will be influenced as well. For suppliers to the EU, this means that demand from EU for them decreases, or that the maximal willingness to pay can only drop, or that there is an additional backstop technology. Whatever the market conditions on the EU gas market, the contract price should now decline, because otherwise they would be left with unsold reserves, and they would not maximize their discounted profits.

   b) What is the effect on oil prices now?
(answer in max 5 lines)

Gas is a substiute for oil, so larger gas reserves in China and the US result in lower gas prices there, and so world demand for oil will decrease in the future. As a result of that, oil prices will decrease now.

c) What is the effect on the price of CO_2 rights now?
(max 6 lines)

Demand for CO_2 rights in the EU market is mainly determined by the ratio of the price of carbon and the price of gas in ELEC production, and by demand for gas and oil in the industry. When the price for gas decreases, less carbon and oil will be used, so less rights are necessary and their price will drop.

3. Germany has decided to close its nuclear power plants earlier than previously determined. This means that about 22% of current electricity production will have to be replaced by other types of plants. Some German ministers see a unique opportunity to endow the renewable energy sector with a much bigger role. Even without the nuclear phase out, Germany was well on its way to achieve the EU target for renewable energy (about 20% of electricity production needs to be renewable by 2020). Is it wise for Germany to increase this share to 25%, and provide higher Feed-in tariffs for RE?

(max 12 lines)

When nuclear power plants are being closed, other plants are needed. The marginal cost of classic fossil fuel plants and renewable energy is increasing. So one can expect a higher price, and a lower demand for electricity. This means that the 20% target will be achieved more easily. Closing the nuclear plants also entails an increase in the price of CO_2 rights, and this is an additional incentive for renewable energy. So with the existing support for RE, Germany will probably already reach a target that exceeds 20%. There is no need for additional incentives (higher FIT).