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WIEN



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Institut für Energiesysteme und Elektrische Antriebe  
Energy Economics Group (EEG)

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VU Selected Topic in Energy Economics and Environment  
14.10.2024  
Homework 1

Submission date: 28.10.2024, 13:00

## Intercontinental gas imports to Germany

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Germany has very little natural gas reserves of its own and therefore has to import the majority of its natural gas. The annual import of natural gas in Germany is around 100 billionm<sup>3</sup> (=1000 billionkWh) in order to meet the corresponding demand (the country's own natural gas reserves and the consumption already covered by them are already excluded; these no longer have to be taken into account in the future).

Until February 2022, the demand for imported natural gas in Germany was composed as follows (for the sake of simplicity, the respective quantities can be equated with the technically available import capacities for the following calculations):

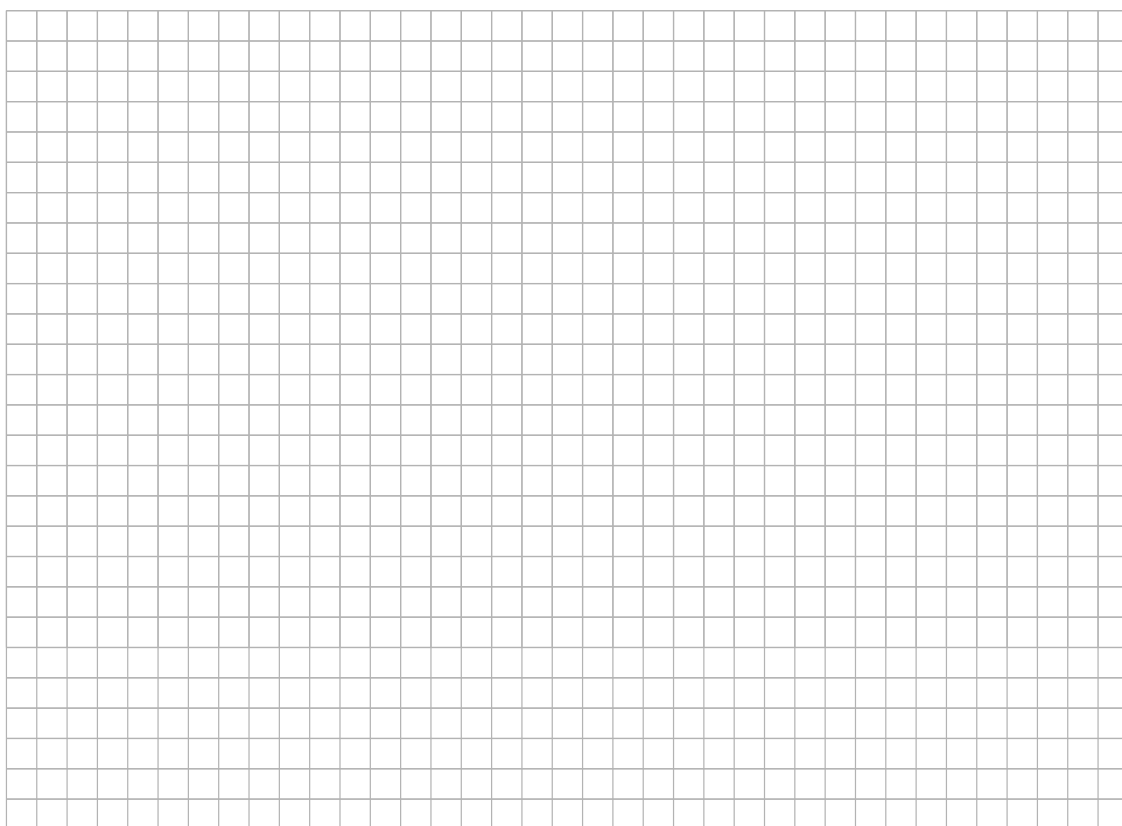
- 30 % from Russia (10 % via Nord-Stream-Pipeline (Baltic Sea), 10 % via Poland/Belarus, 10 % via Austria/Czech Republic/Slovakia/Ukraine)
- 30 % from Nord Sea (Norwegian waters)
- 25 % from The Netherlands/UK
- 10 % from Belgium
- 5 % from Denmark

Until February 2022, the corresponding gas volumes via the individual import routes were offered at the transfer points to Germany at the following wholesale prices:

- Nord-Stream-Pipeline (Ostsee): 7 EUR/MWh
- Poland/Belarus: 9 EUR/MWh
- Austria/Czech Republic/Slovakia/Ukraine: 10 EUR/MWh
- Nord Sea (Norwegian waters): 8 EUR/MWh
- The Netherlands/UK: 12 EUR/MWh
- Belgium: 13 EUR/MWh
- Denmark: 15 EUR/MWh

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- a) Draw the supply curve for natural gas imports in Germany (axis labeling!) and determine the most expensive import route.



- b)** Based on the above, calculate the so-called IRD factor (Import Route Diversification) for Germany. The IRD factor is defined as follows:

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$$IRD = \sum_l (IP_{Xborder,l})^2 + \sum_m (LNG_{terminal,m})^2 \quad (1)$$

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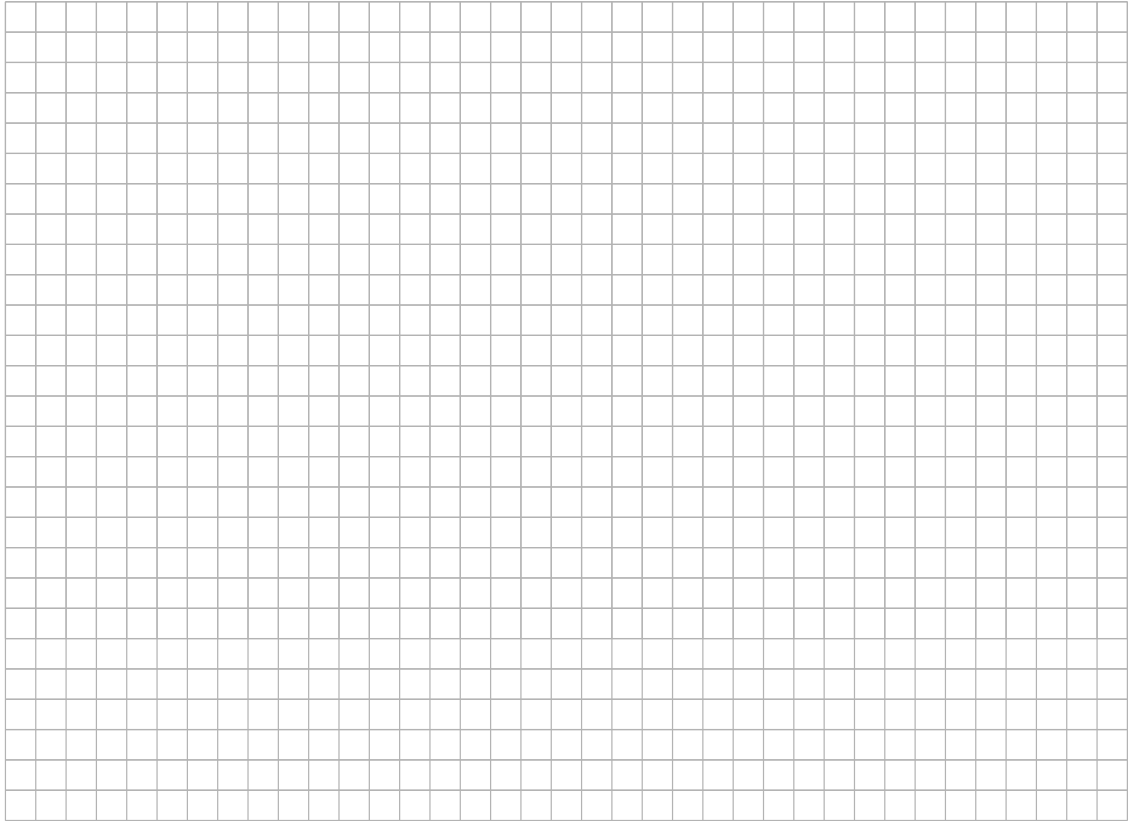
- $IP_{Xborder,l}$ : Import share on Pipeline-Interconnector  $l$ ,
- $LNG_{terminal,m}$ : LNG share on terminal  $m$ .

- c)** It has already been assumed in previous years (i.e. before February 2022) that due to political tensions with both Ukraine and Belarus, there may be supply interruptions at any time and the 2 corresponding gas import routes to Germany are no longer fully available (i.e. it is assumed that the 3rd route (Baltic Sea pipelines) is still fully available). If it is now assumed that a corresponding loss of imports of "Russian gas" via these 2 routes to 80 % is compensated by newly built LNG terminals on the coast of northern Germany and to 20 % by import capacity expansions from the North Sea (Norwegian waters): What is the new IRD factor for Germany according to this new situation?

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- d) Draw the new supply curve for natural gas imports in Germany assumed under point c) (axis labeling!), if it is assumed that the newly added LNG quantities have 3 times the price level as the most expensive import route to date under point a. The volume expansions from the North Sea will be offered 10% below the price level of the newly added LNG volumes.

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- e) If, on the basis of the situation under Point d) with regard to LNG (for piped North Sea gas (Norwegian waters) use the parameters under Point a): 30% and 8 EUR/MWh), the following is assumed: Now the German gas market will be "flooded" in the long term up to the fully available LNG capacity of 60 billion m<sup>3</sup> at a price of 10 EUR/MWh. Which import routes will be kicked out from the gas supply as a result? Which import route is now the most expensive one? Please draw this new gas import supply curve for Germany below?

