

Jörg Düweke and Thomas Hamacher

MODELLING NATURAL GAS MARKETS – THE COSTS OF SECURE NATURAL GAS

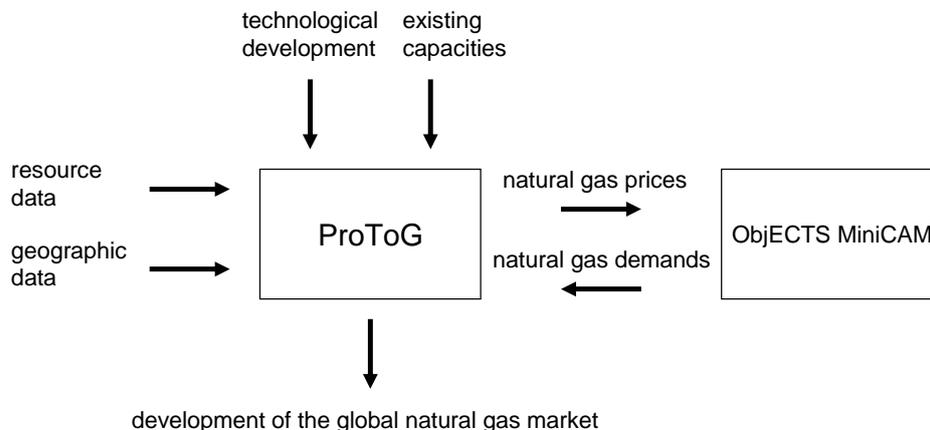
Max-Planck-Institut für Plasmaphysik (IPP), Boltzmannstraße 2, D-85748 Garching
Phone.: +49 89 3299 1457; Fax: +49 89 3299 2183; E-mail: Joerg.Dueweke@ipp.mpg.de

Within the last 30 years the share of natural gas in the global primary energy supply increased from 16% to 21%. At the same time the share of oil decreased from 45% to 34%. Natural gas supply has reached nearly the level of coal. In the future there will be a competition between natural gas and coal to become the second most important primary energy carrier.

Different from oil or coal, transportation costs affect natural gas prices significantly. Thus no global natural gas market was developed. There are four separate regional markets with total different gas prices. Due to the development of LNG technologies and the increasing energy prices, these regional markets can become one global market. The following paper investigates the evolution of the future gas market. Will high transportation costs prevent the formation of one global natural gas price?

To answer these questions a special model framework was developed: The global model for Production and Transport of Gas (ProToG) is linked to the global energy model ObjECTS MiniCAM (Fig. 1). Whereas the ProToG model represents the global technical natural gas infrastructure in a very detailed way, ObjECTS MiniCAM simulates the natural gas demand against the ProToG prices.

Fig. 1: Modelling framework



The ProToG model minimizes the production and transportation costs of natural gas. It is a linear model and uses 5-year-time-steps with a time horizon from 2005 until 2050. ProToG has a detailed resource and transportation data base. It represents 113 countries with 464 possible pipeline connections and 8556 possible LNG-tanker routes. Every country is able to produce natural gas according to its domestic resources. They have to satisfy their demands with their domestic natural gas or gas imports. The gas demands are calculated by the ObjECTS MiniCAM. MiniCAM is a partial-equilibrium model designed to examine long-term, large-scale changes in global and regional energy systems.

ProToG describes the development of the future global natural gas market. It calculates the most economic pipelines and LNG routes with a detailed focus on the location of natural gas resources. Moreover ProToG defines the natural gas supply by origin and presents the marginal costs of natural gas for every modeled country.

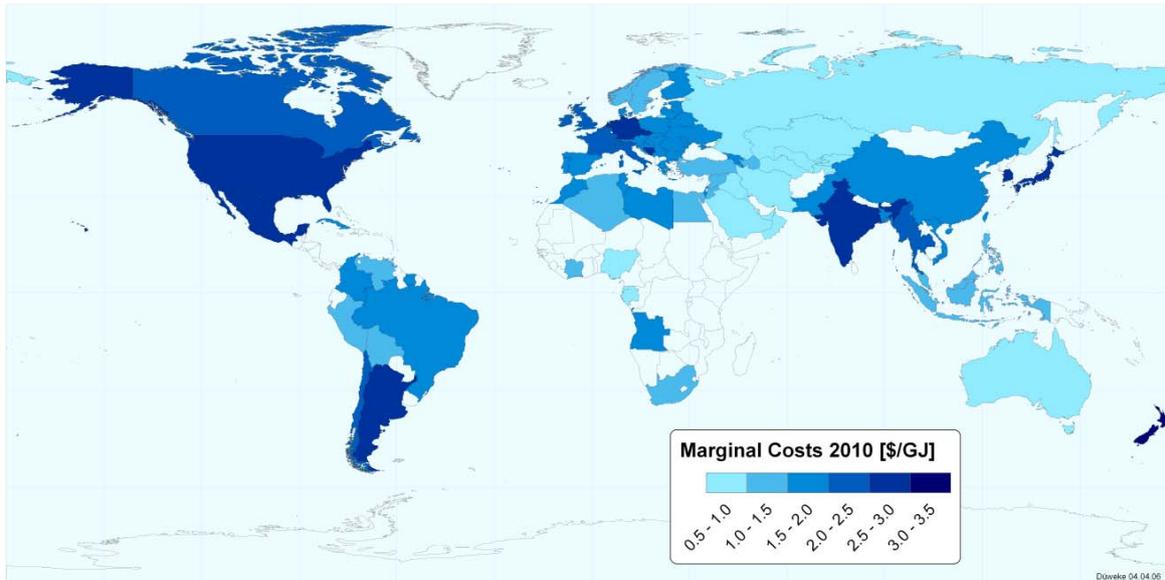


Fig. 2: Worldwide Marginal Costs of Natural Gas in 2010

The security of gas imports depends on the numbers of importers and of different transportation routes. The ProToG model verifies the marginal costs for some German security scenarios by varying the restrictions of natural gas imports for each importer. The worldwide marginal costs of natural gas in the base case are shown in **Fig. 2**. The map illustrates the costs in \$/GJ in the year 2010.

References

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