THE PROSPECTS OF NATURAL GAS IN A FUTURE ENERGY SYSTEM: A PROBABILISTIC APPROACH

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Overview

The fight against global warming and prevailing decarbonization trends make the prospects of natural gas ambiguous. On the one hand, decarbonization requires either to reduce the use of natural gas and other fossil fuels or to employ carbon capture and storage solutions which bring additional cost and decrease the attractiveness of fossil resources. On the other hand, natural gas has several advantages compared to other fuels. It is a relatively clean fuel regarding greenhouse gas emissions and other types of pollution such as particulate matter. Thus, the shift from coal or other more polluting fuels to efficient natural gas technologies might mean a significant move towards decarbonization, especially if the problem of fugitive methane emissions is solved. Flexible natural gas-fired units used for peaking and reservation can efficiently complement variable generation from renewables and increase their integration possibilities. These factors provide some ground to consider natural gas at least as an important transitional fuel. Moreover, the recent changes in natural gas markets (the developments of shale gas, the export of liquified natural gas from the United States, and a number projects that expand natural gas infrastructure) and growing energy demand seem to provide even better prospects for natural gas.

In global energy outlooks, there is no firm consensus on the future role of natural gas. In the projections of BP Energy Outlook (BP, 2017) and International Energy Outlook (EIA, 2017), the increase of natural gas consumption in absolute terms will be at the similar level as the growth of solar, wind, and other renewable energies together in the period of 2015-2035. On the contrary, the New Energy Outlook by Bloomberg New Energy Finance (2016) states that “gas’ role as a 'transitional fuel’ appears overstated outside the US.” If natural gas plays a supplementary role to quickly expanding renewables instead of replacing coal in baseload generation, gas capacity increases will fail to lead to corresponding increases in natural gas consumption (Bloomberg New Energy Finance, 2017). Different scenario assumptions lead to considerably different global natural gas demand projections in World Energy Outlooks (IEA, 2016; IEA, 2017).

At the regional level, discrepancies are even more substantial, and this is especially evident for such regions as Europe where ambitious decarbonization measures are considered. However, projections play an essential role in energy investment decisions since they may show for which regions and markets the prospects are firmly promising, and where the future of natural gas is much more uncertain.

Methods

The analysis of the literature and stochastic modelling are the primary methods of the present research. The data from the newest energy outlooks about natural gas production and consumption volumes, capacities, prices, import and export flows are used as a basis to build the probability distributions of the essential parameters and to form the model employed in the research. This model enables the quantitative evaluation of interrelated uncertainties determined by the availability of resources; demand fluctuations; political commitments; the spread of new technologies and energy sources; strategic decisions of gas importing, exporting, and transit countries; and the development of infrastructure.

Results

In the paper, natural gas production and consumption trends are reviewed and our meta-study quantification method presented in detail. Considerable attention is paid to the ranking of data sources and creation of probability distributions as well as to the modelling natural gas flows through different supply routes. The model is employed to reveal the prospects of natural gas in a future energy system both at a global and regional level in the long-term period.

Conclusions

The analysis shows that natural gas will remain one of the most critical fuels, but its global consumption will not necessarily grow as fast as predicted in some outlooks (e.g., Global Gas Outlook). However, the probability of a reduction in consumption of natural gas is relatively low in the period up to 2040. It seems that overall energy transformation pathway will be the primary factor influencing the prospects of natural gas and game-changing technological breakthroughs may result in the decreasing global demand for natural gas.
At the regional level, Asia seems to be the most certain natural gas export destination, while the European situation will depend on the success of policies related to both decarbonization and regulation of natural gas markets. Also, US policy regarding the exports of natural gas will have a considerable impact on all major natural gas markets.

References

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