EXPLORING THE ROLE OF EUROPE IN THE GLOBAL LNG MARKET EQUILIBRIUM UNTIL 2040

Sebastian Zwickl-Bernhard, Energy Economics Group (EEG), zwickl@eeg.tuwien.ac.at
Marcus Otti, Energy Economics Group (EEG), otti@eeg.tuwien.ac.at
Antonia Golab, Energy Economics Group (EEG), golab@tuwien.ac.at
Hans Auer[1], Energy Economics Group (EEG), auer@eeg.tuwien.ac.at

Overview

The core objective of this work is to analyze the global equilibrium of the liquified natural gas (LNG) market until 2040. Our focus is on the volumes of LNG traded between major importing and exporting countries to meet projected demand and to determine regional LNG prices for Europe. To achieve this, we propose a simplified linear optimization model that minimizes total costs. Present results show that the price of LNG in Europe will be around 42 EUR/MWh on average in 2040. Our results also show that United States will supply high shares of LNG demands in Europe and will take over the role as global marginal exporter in 2040. Our work provides novelties and contributes to scientific literature because of for two reasons. First, expected LNG volumes and corresponding prices are critical for energy system planning in Europe (as seen in 2022). This is especially important given the absence of Russian pipeline gas, as it impacts energy security. Additionally, it also affects the economic competitiveness of renewable energy-based technologies. By providing insights into LNG volumes and prices, our work has the potential to inform decision-making processes around energy system planning decisions and contribute to a more secure and sustainable energy future in Europe. These aspects of LNG and its role in energy security and economic competitiveness of renewable energy are exemplarily discussed in detail in [1] and [2] respectively.

Methods

We develop and apply a simplified linear optimization model. The objective is to minimize the total cost of LNG imports (i.e., the sum of the delivery ex-ship price times imported volumnes for all importing countries) while satisfying all exogenously determined LNG demands of the importers. Demand is assumed to be inelastic. In the model, import and export countries are represented by nodes. The exporter is assumed to bear the obligation and cost of transportation. Optimality of the model finds, among other things, optimal LNG flows from each exporting country to each importing country. Input parameters include LNG import volumes (i.e. demand) with monthly resolution, LNG export capacities and LNG break-even prices. Break-even prices encompass the cost of feed gas, investment in liquefaction facilities, and royalties and taxes. Spatial and other techno-economic data are used to calculate LNG transport costs between nodes. In addition, we consider constraints in the model to ensure diversification of exporting countries. We use available data on import and export volumes, in addition to observed LNG prices in 2019, to validate our model.

Results & Conclusions

Based on the results of our study, the following interesting observations can be made: (i) Due to the comparatively short ramp-up time and the flexible use of LNG in energy systems, a significant increase in LNG consumption can be expected by 2040, especially in Europe. (ii) The trends in the geographical distribution of LNG prices in 2040 are similar to historical prices. Thus, the LNG market and its prices in 2040 can be divided into the Atlantic Basin, the Pacific Basin and the Middle East region, as is the case today. (iii) In Europe, the results indicate an increase in LNG prices to around $12.2 per mmBTU (around EUR 42 per MWh) by 2040. (iv) In 2040, the United States will supply high shares of LNG demand in Europe and will assume the role of global marginal exporter. In addition, the potential increase in export capacity of individual countries (such as the United States) will lead to the need for medium and long-term supply contracts for marginal exporters.

References

[1] H. J. Magnier & A. Jrad, A minimal simplified model for assessing and devising global LNG equilibrium trade portfolios while maximizing energy security, *Energy*, (2019), 173, 1221-1233, doi: https://doi.org/10.1016/j.esr.2021.100734

[2] A. Meza, et al., Future LNG competition and trade using an agent-based predictive model, *Energy Strategy Reviews*, (2021), 38, 100734, doi: https://doi.org/10.1016/j.esr.2021.100734

[1] Corresponding author/presenter