CALCULATION OF THE MAXIMUM COMMERCIAL BORDER CAPACITY IN INTERCONNECTED GAS NETWORKS

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Overview

The internal natural gas market requires an adequate calculation of the maximum commercial border capacity to ensure an efficient access to gas trading places in order to achieve competitive prices and gas liquidity in the European Union. It is necessary for gas markets as well as for national regulatory authorities (NRAs) to gain a better understanding of the mechanisms determining the level of border capacity offered by the transmission system operators (TSOs). This issue is most relevant in events of contractual congestion where network users cannot obtain access to a transmission network. The status of contractual congestion is difficult to examine since transparent methodologies to calculate the network capability are lacking and methods may strongly vary from TSO to TSO. In order to ensure that congestion management procedures and investment policy are applied in the most effective way, it is of great importance to appropriately determine the maximum commercial capacity of each cross-border interconnection point. The introduction of an entry-exit market model in Europe has greatly contributed to the flexibility for market participants of network use but has complicated the calculation for TSOs of the effective capacity of networks. The way booked capacity is used by the network users determines more and more the amount of firm border capacity that TSOs are able to offer. Technical as well as commercial measures can be taken to maximize the commercial border capacity in order to meet demand. The paper addresses the behavioural determinants for the capacity availability and the commercial measures to maximize the available capacity in order to objectivize capacity calculations methods and to achieve cost-efficient capacity offers.

Method

The paper provides insights into the important features which determine the capability of a gas network in an entry-exit gas market model. The performance of network models to simulate the hydraulics of a gas transmission network is not questioned. On the contrary, assumptions regarding the dynamics and uncertain elements due to a growing number of different network users are more and more important for capacity calculation purposes. Analysis of market behavior is an increasingly decisive part of capacity calculation, an activity which was traditionally only based on engineering concepts and methods. The understanding is improved by an assessment of the key assumptions and the parameter-setting TSOs have to make in order to run the network simulation models and to provide a capacity offer for the market. The underlying trade-offs made by the TSOs are discussed and confronted with thresholds considered as reasonable from a market regulatory point of view. It will be demonstrated that the capacity of network to transport gas is more and more determined by how this network is being used by the market participants. These behavioural factors lie largely beyond the control of the TSO, vary continuously and are difficult to predict, especially in networks with important cross-border gas transactions. Growing market volatility, increasingly shorter term gas transactions and rapidly changing sourcing and flow patterns require a flexible gas network. For example the intermittency of solar and wind for power generation has increased the demand for network flexibility to supply back-up gas-fired power plants. The entry-exit network model design was introduced to provide the required flexibility. However, more network flexibility for the market participants has an important trade-off in terms of pinpointing the offer of firm capacity to the market. The impacts of the behavioural factors of the network users are examined in order to give guidance on the assumptions and parameters to cope with the probabilistic utilization of networks. The more networks and flows are integrated and meshed, the more capacity calculation becomes probability-based. The discussed dynamic scheme for capacity calculation, and recalculation, pays special attention to the commercial measures to maximize commercial capacity. The oversubscription and the market-based capacity buy-back procedure perfectly fit in an capacity calculation approach where behavioural aspects and risk profiles ultimately determine the level of firm capacity offered to the market. The assessment is largely based on on-going regulatory assessments of TSOs capacity offers, events of contractual congestion and procedures to release a maximum of unused capacity to the market.

Results

The predictability of the network use is finally the key factor to determine the offer of firm border capacity. Entry-exit systems operated by more risk-avert TSOs or less predictable consumption levels and gas flows, will generally offer less firm capacity. The trade-offs TSOs make as well as the responsiveness of the level of firm capacity to these choices are discussed. This assessment objectivizes as much as possible the parameter-setting for capacity calculation from a regulatory point of view. Risk-profiles are key for offering firm capacity and possibly additional capacity as long as impacts on the capacity buy-back obligations for TSOs are not excessive.
Guidelines are provided to reflect as much as possible the dynamics of the market in a dynamic capacity calculation at each cross-border interconnection point to meet capacity demand. For example, the potential of capacity reshuffling between border interconnections (generally non-linear substitution) in order to meet capacity demand at congested interconnection points should be part of the capacity calculation method. The findings of the analysis are confronted with the requirements of the European regulation regarding calculation methods and congestion management procedures in the event of contractual congestion. The analysis paths a way to objectivize capacity calculation methods in Europe and to move to joint cross-border calculation methods as required in the European Network Code on capacity allocation mechanisms (Regulation 984/2013).

Conclusions

Risk-taking by the TSO finally determines the amount of firm border capacity offered on the market in an entry-exit system. The commercial capability of a transmission network is extremely responsive to the choice of assumptions and parameter-setting regarding expected flow patterns and gas offtakes. In this area, TSOs are largely free to decide. Risk profiles for offering capacity and additional capacity should be objectivized in order to allow national regulatory authorities to assess the level of firm capacity offered. These risk-profiles are of key importance to assess events of contractual congestion and capacity buy-back obligations where TSOs have to buy-back capacity in order to guarantee capacity for those network users which make physical use of their capacity rights.

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