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THE TRANSITION TO IMPORT DEPENDENCY AND ITS CONSEQUENCES FOR THE SECURITY OF GAS SUPPLY: A QUANTITATIVE APPROACH

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Overview

Gas market liberalization was designed and implemented in an era of oversupply from sources within Europe. One of the most important developments in European gas markets since then has been the depletion of indigenous resources and, as a consequence, an increasing dependency on imports. As the liberalized market is geared specifically to increasing competition rather than securing supplies and delivery, some structural changes are required. To complete this transition successfully, the concerted action of governments, producers, suppliers and infrastructure companies is required. If adjustments are not made in time, this could threaten the security of supply. In this study, an agent-based model of the gas market is used to simulate this transition and identify aspects of the transition that could pose a threat to the security of supply.

Method

An agent based simulation model is employed to study the issue of import dependency and security of supply. Agent-based simulation uses autonomous decision-making units ('agents') as its building blocks. The model incorporates five different types of agent to cover the whole value chain: producers, transporters, storage operators, traders and consumers. Technical infrastructure such as reservoirs, pipelines and storage facilities is included as a feature of particular agents. Various types of behavior can be programmed into each type of agent, ranging from profit maximization to the performance of public duties.

Agents are connected in one of three ways: they are integrated into a single company, are connected through a bilateral long term contract, or trade on a (spot) market. A combination of agents, contracts and markets is chosen to create an initial market structure. A dynamical simulation is then performed to determine the behavior of the model over time. Changes in market structure are endogenously initiated by the actions of agents. The security of supply is quantified as a probability of supply-demand equilibrium and is a function of initial market structure, agent behavior and data.

Results

Three developments were identified that threaten security of supply:

- 1) A shift from bilateral long term contracting to short term market trading is occurring. Although this improves short term allocative efficiency, it reduces the ability of companies to plan for the long term and enter into long term agreements to secure gas;
- 2) A shift in flexibility provision from production swing to storage facilities is needed because nearby gas fields are nearing depletion and swing capacity is reduced. However, it is still unclear who will develop the seasonal storage facilities required and if enough capacity will become available;
- 3) The construction of additional interconnection and transport capacity (both LNG and pipeline) is required as gas has to be transported over longer distances. However,

construction is hampered by uncertainty, regulatory intervention and problems regarding system interoperability.

Conclusions: The current liberalized market structure inherited from an era of oversupply needs to be adjusted to the new situation of import dependency. The model presented quantifies security of supply risks and identifies three particular areas of concern.