

The Role of Natural Gas in a Low-Carbon Europe

Infrastructure and Supply Security

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Executive summary

The role that natural gas will play in the transition to a decarbonised European energy system is unclear. Dependent on the role of natural gas in the energy supply, different types of infrastructure will be necessary to accommodate import and distribution within Europe. A broad range of perspectives regarding the future of natural gas in the European energy mix exists: natural gas could play the role of a *bridge fuel* during a transition phase or serve as the main *backup fuel* for intermittent renewable power generation. However, natural gas could also be steadily phased out and substituted for by non-fossil fuel alternatives, which will quickly become economical under stringent climate policies. While the European Energy Roadmap to 2050 proposes a development in the latter direction with natural gas consumption declining over the next few decades, the International Energy Agency's New Policies Scenario suggests a consistently large role for natural gas in Europe in the coming decades.

In this paper, we take a closer look at how the envisaged decarbonisation scenarios of the European energy sector will affect the natural gas sector. We focus on infrastructure needs in the natural gas sector to accommodate the transition to a low-carbon economy. To this end, we apply the Global Gas Model, a multi-period complementarity model of the world natural gas market. We analyse three potential and quite opposite pathways for the role of natural gas in Europe: first, a continuously decreasing consumption of natural gas in the EU; second, a slightly increasing consumption path; and third, the role of natural gas as a “bridge fuel” to a low-carbon Europe.

First, we construct two climate scenarios based on the EU Energy Roadmap 2050. Both scenarios are characterised by decreasing natural gas consumption—the more stringent the climate policy, the lower the level of consumption. Consequently, in the 80% GHG reduction scenario, there is no need for large-scale pipeline expansions. In the moderate climate policy scenario, however, the decline in European domestic production and the increasing reliance on African and Caspian exports lead to some expansions of import capacity. This includes pipeline expansions from Africa to Spain and Italy, and from the Caspian region to Central and East Europe. European LNG imports, in turn, stagnate and even fall after a peak in 2020 because of strong demand in the Asia-Pacific region. The availability of shale gas, in the form of LNG exports from North

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America and with increased production capacity in some major demand regions of the world (e.g., China, Poland), could change this picture somewhat, by reducing the competition for natural gas with Asia-Pacific.

Second, we construct a set of alternative scenarios that are comparable in the underlying reduction of greenhouse gas emissions, but that differ in their projected, continuously increasing natural gas consumption. Capacity expansions in the moderate climate scenario with rising EU natural gas consumption are significantly higher than in the Reference scenario. This holds particularly for the connections from Africa and the Caspian region to Central Europe and includes a new pipeline from the Middle East towards Turkey, Greece, and Italy. The results of the Bridge scenario, with only temporary increases in natural gas consumption, show that long-term trade relations are needed to economically justify pipeline infrastructure construction. Instead of large-scale pipeline expansion, the existing idle LNG import capacities are used during years of high demand, supported by some additional expansions in LNG regasification facilities.

All scenario results show improved import diversification due to the build-up of West-East (reverse flow) capacity. This is the result of an economic cost minimisation mechanism in a capacity-constrained market with market power despite no explicit consideration of supply security considerations. In other words, supply security would benefit from relaxing the (institutional, political, and technical) constraints on investments as we assume for the period after 2020.

The next decade will determine if the tendency towards lowering natural gas consumption in Europe, as indicated by the Energy Roadmap, will come to fruition. In contrast, a stronger reliance on natural gas may be a probable energy future and our alternative scenarios indicate the economic feasibility of such a pathway. There is a need for a clearer picture regarding the role that natural gas may play in Europe in the upcoming decades. This is particularly necessary for today's decisions on the future natural gas infrastructure.