

Implications of global unconventional gas development – Climate policy versus market effects

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Motivation

Nowadays two topics are on top of the agenda of global energy policy discussions. On the one hand, climate change issues and security of supply, on the other hand. Therefore, strong emphases are put to diversified as well as sustainable energy supply portfolios. However, in this context national circumstances, as energy resources and political frameworks, vary significantly among different regions worldwide. Additionally, the market integration of renewable energy technologies faces different challenges depending on the energy sector. Up to now, much more experience exists in the integration of renewable energy sources in the electricity and heating sector whereas the transport sector will still rely on fossil energy sources for a longer time period¹. Furthermore, a more sustainable energy supply portfolio, driven by a high penetration of renewable energy sources (RES), additionally implicates the challenge of the volatile output character and, thus, the need of fast responding balancing energy. Consequently, this opens new markets for an enhanced unconventional fossil energy development, supplying additional back-up energy from a broad diversified energy export portfolio.

In context, a large share of conventional gas resources is, besides Russia, located in the Gulf region. Therefore, the various gas liquefying stations in this region allowed for a flexible export of domestic resources to all relevant energy markets between the United States and Japan. However, a majority of the known gas resources in the Gulf region belong to the associated category. This fact implies that gas can only be exploited when oil is extracted which is however limited by OPEC regulations. Consequently, several countries in the Gulf region are expected to even become gas importing countries, if their domestic demand increases as foreseen in all scenarios. Moreover, the recent political framework conditions in many regions worldwide increases the demand in natural gas significantly. Especially, the rapid phase out of nuclear energy in Japan but also the foreseen phase out of nuclear in Europe are strong drivers in this respect. These facts carry out the attractive implications of an unconventional gas development.

¹ Not only the technology development is much more mature in the electricity sector but also the infrastructure system development enables a more cost-efficient integration of RES in the electricity than in the transport sector.

Method of approach

First, a comprehensive assessment is carried out addressing the political framework conditions for energy supply in several regions worldwide in particular, the United States, Europe, the Gulf area and Japan. A specific focus is put on the domestic energy resources, their sustainability policy schemes and their energy demand forecasts. Moreover, scenarios of future expectations in terms of energy supply are taken into account.

Second, a quantitative analysis elaborates on the characteristic of conventional natural gas resources. Of special interest is the share of non-associated gas on total conventional resources as well as their extraction costs. Moreover transmission and distribution opportunities and the associated costs are considered, in order to highlight the flexibility and cost-competitiveness of conventional gas on international energy markets. These identified characteristics are compared to those from unconventional gas reserves.

Finally, quantitative implications from an enhanced unconventional gas extraction for other energy markets are drawn. This paper addresses in detail the impact of unconventional gas exploitation on international coal markets, the European Emission Trading Scheme and the operation of electricity markets. Sensitivity analyses underpin the strong link between the unconventional gas development and other energy carriers, such as coal, nuclear or renewable energy sources.

Results

As a first consequence of the rapid, cost-competitive US unconventional gas development their electricity supply portfolio switched from a high share of coal towards more gas installations. The US do not pursue significant gas exports in future, but rather keep the intensive and cheap unconventional gas resource domestically and support their re-industrialization process. In the meantime Europe follows a proactive support of renewable energy technologies in order to reduce its CO₂ emissions. However, renewables are characterized by volatile power output and higher generation costs. Thus, adequate back-up power is required whereas the recent trend goes towards coal power plants. Coal prices decreased significantly since the unconventional gas revolution in the US and their excess coal is redirected towards Europe and other energy markets². Consequently, due to the market competitiveness of coal power plants significant new capacities are being installed in Europe, emitting high quantities of CO₂ although a remarkable share of its GDP is spend for supporting renewable energies.

In context, the intention of the US not to export significant shares of their unconventional gas resources empowers traditional gas exporting countries to meet the global demand and therefore set the price. Especially the Gulf countries have high interests in keeping the gas price on current levels in order to stabilize their monetary revenues and thus keep their domestic welfare system alive. Additionally, the happened phase out of nuclear energy in Japan and the scheduled phase outs in Europe increase the demand in other energy sources, amongst others especially gas. This fact makes a further extraction of unconventional gas resource, in other than US regions, economically attractive.

Hence, the unconventional gas development shows a global dimension with huge implications to other energy carriers and other energy markets due its cost-competitiveness in selected regions.

² CO₂ prices within the ETS scheme are currently low too, due to the high pre-allocation of certificates.