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# The optimal regulatory framework for the EU gas market

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## A discussion paper on regulation and welfare maximization

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## Abstract

*With the EU internal market for natural gas almost complete, the European Commission poses the question what optimization potential remains. An optimal structure for the natural gas market balances the goals of competition, competitiveness and supply security. An analytical framework capable of taking these into account applies a broad toolkit, using both qualitative and quantitative analysis. Quantitative analysis should combine simulation, benchmarking and stress tests. It encompasses the whole value chain, from production, via LNG, transport, storage and trade to consumption. The most promising areas for optimization are attracting more supplies to the EU, balancing infrastructure investment with cost control and facilitating trade by increasing market integration.*

## Introduction

The European gas market is at a crossroads. Over the last twenty years or so, the European Union has moved step-by-step towards a single European gas market. By now, the original vision is nearing completion. This calls for a reappraisal of both the goal of the reform and the instruments used to achieve it. To this end, the European Commission has commissioned a study with the objective to "assess i) whether market functioning and with it overall welfare within the EU can be improved through a revision of the current internal market regulatory framework and if so, ii) what specific regulatory measures should thus be assessed from a cost-benefit point of view" (EC, 2016).

Notwithstanding the above, the natural gas market is still highly dynamic, with many developments taking place in parallel (Correljé, 2016). Some developments proceed mostly autonomously, such as the transition from indigenous production to import dependence. Others are partly autonomous and partly a result of policy. For instance, the demand for gas in the power sector has clear links

with EU climate policy. At the same time, it is influenced heavily by the global market for coal. Finally, the regulatory environment of the gas market is, at least in principle, fully under control of EU legislative bodies. However, different implementations of EU guidelines at the national level can create a degree of divergence which is hard to control.

Regulation is only necessary in the case of market failures. Most gas transport infrastructures are natural monopolies. This is the first reason for regulating the gas market. This involves typical regulatory tasks such as tariff regulation and regulation of the access to the infrastructure. Another motive for regulation is the creation of a well-functioning wholesale market, i.e., the conditions for competition on a level playing field, which enhances the process of pricing. Finally, the importance of secure supplies combined with the geological limits to production, is a reason for intervening in the market.

This paper focuses on the results of regulatory change, rather than the process. Each addition to or adjustment of the regulatory framework is judged primarily on the basis of its outcome. A cost-benefit analysis is based on the change in welfare of all market participants in the new situation compared to the old one. This perspective regards the current regulatory framework as a solid basis, but a basis that needs further fine-tuning.

There are of course other perspectives on regulation, which will not be addressed in this paper. Two of those perspectives are touched upon briefly below.

The first is to look at the costs and benefits of the regulatory intervention process itself. Designing and implementing regulation takes time and effort and the costs of compliance with regulation can also be significant. In addition, repeated regulatory intervention causes regulatory uncertainty. This in turn may lead to inaction or short-sighted behavior by market participants due to risk-averseness. For this reason, it could be argued that regulatory intervention should be minimized. Only if the benefits of the intervention can be shown to outweigh the costs, regulatory change should be considered. From this perspective, the completion of the single energy market marks a logical end point of regulatory development rather than the start of a new trajectory. The main objective should then be to ensure the complete implementation of the regulatory model and provide stability to both market participants and national governments.

The second perspective is to question the economic foundations of the current framework itself and compare it with alternatives. For instance, it could be argued that minimizing natural gas consumption is optimal from an environmental perspective. Similarly, from a political perspective, the import of natural gas could be viewed as an unwanted subsidy of non-democratic or even hostile regimes. In that case, the usual assumptions about maximizing welfare by maximizing consumer and producer surpluses do not apply and economic goals are made secondary to policy goals of a different nature.

We acknowledge that the intervention of policy makers in the functioning of the natural gas market has its drawbacks. Furthermore, the merits of market liberalization and market integration as such, founded on welfare economics, can be questioned. However, both issues are beyond the scope of this paper.

The main question we will address in this paper is therefore as follows: *is the current EU regulatory framework for the natural gas market optimal from a welfare perspective and, if not, what incremental improvements can be identified?*

The next section sketches a welfare framework which takes into account both affordability and supply security. It also looks at the contribution which quantitative models can make to welfare assessment. To identify possible improvements to the regulatory framework, we must then delve into the structure of the natural gas value chain to see what parameters are available to policy makers for optimizing welfare. Next, some options for optimizing the structure of the natural gas market are presented. The discussion paper ends with a brief conclusion.

## Multiple policy goals in a single welfare framework

The answer to the research question stated above revolves around three topics. The first is how to measure the welfare of a given market structure. Such a measurement has to cover the whole value chain and the welfare of each actor has to be considered. Traditionally, welfare is measured by the consumer and producer surplus of all relevant product markets. However, in the case of multiple policy goals, welfare measurement becomes more complex.

In its call for tenders, the European Commission states as its policy objectives: “competitiveness, competition, security of supply and sustainability” (EC, 2016). The goal of sustainability is explicitly placed out of scope, which leaves the former three to be addressed in a welfare framework. Competitiveness and competition can more or less be equated to traditional welfare measurement, but security of supply requires a different approach (Benthem, 2009).

Supply security can be interpreted in different ways, because supply can be disrupted for different reasons (IEA, 1995, 2004). In the case of flawed market design, short term disruptions in supply or long term lack of investment may occur because the regulatory framework creates the wrong constraints and/or incentives for one or more market participants. Such disruptions can be considered as shocks internal to the economic system. Others are considered to be external to the economic system. Three categories are the most commonly cited. First, supply disruptions can be caused purposely for political reasons, either by acts of terrorism or by withholding gas supply as a form of political pressure. Second, supply disruptions can be caused by the technical failure of important facilities such as vital transport infrastructure and storage facilities. Third, extremely cold weather may temporarily raise demand to a point where existing infrastructure (either transport or production capacity) is not sufficient to fulfil it.

To incorporate supply security in a quantitative welfare framework, indicators for the level of security against each of the risks mentioned above must be defined and measured. For internal

supply shocks, a benchmarking method is most suited. The ideal behavior of market participants can be derived from model simulations with an optimal market outcome under certain restrictions. Such an outcome can then be used as a benchmark for alternative simulations. These alternative simulations can incorporate more realistic behavior of market participants, which diverges from the benchmark behavior. The degree to which the outcome under those alternative assumptions differs from the benchmark, can be used as a measure for the risk of an internal supply shock.

Indicators for the risk of an external supply shock can be derived by performing a type of stress test. The resilience of the gas supply system against exogenous shocks can be determined by creating certain stress scenarios. In the case of a demand shock, the demand curve for gas can be altered to reflect the increase due to cold weather. In the case of political or technical shocks, the capacity of some type of infrastructure can be artificially lowered. The resilience of the system can then be tested by increasing the size of the disruption to the breaking point.

Once the measurement of the welfare associated with a certain market structure is taken care of, the second topic can be addressed. This involves the identification of changes in the regulatory framework that make everyone better off (or at least equally well off), so-called Pareto improvements. The advantage of looking at this type of improvement is that it can be done qualitatively. Since no one suffers from such a change, there are no 'social costs' and therefore the magnitude of the improvement is less relevant. In practice, however, Pareto-improvements are rare, if not absent completely. Especially in a market with a history of regulation as long as the natural gas market, quick wins and straightforward improvements can be expected to have been implemented already.

The third topic is the most complex. It involves assessing changes to the regulatory framework which have both positive and negative consequences. To evaluate such changes, costs and benefits must be quantified to determine the net result from the tradeoff between them. These tradeoffs can take different shapes. The tradeoff may take place between different actors in the value chain, e.g. producers versus consumers. Another tradeoff may be between different policy goals. An increase in the security of supply may require additional investment, which means higher costs and an increase in price. A third tradeoff is between short-term welfare and long term welfare. Consider for instance an investment in additional transport capacity, which requires investment costs in the short term and lowers utilization rates in the medium term, but increases security of supply in the long term.

Therefore, the use of quantitative models for measuring welfare is indispensable for a complete evaluation of a regulatory framework. At the same time, quantitative models have some pitfalls. While a large range of large scale gas market models have been developed over the years, they all share a similar set of basic assumptions and therefore suffer from the same drawbacks. See Golombek et al. (1995) for the original model that subsequent models were based on.

The most important of these is a lack of realistic behavior by market participants. Phenomena such as uncertainty, imperfect information, imperfect foresight and a lack of coordination between actors are not incorporated in these models. For this reason, it is difficult to incorporate the effects

of regulation on behavior in a model directly. An indirect approach is more viable. This entails translating the effects of regulation into a market structure that can be modeled. The model will then generate an outcome that resembles the outcome under the actual market structure. Outcomes obtained in this way must therefore be interpreted with caution.

Another point of concern is the granularity of the model. Models necessarily aggregate the gas market, both in time and in space, into chunks that are amenable to modeling. The higher the degree of aggregation, the greater the risk of supply interruptions being obscured from sight. For example, extreme highs and lows in demand or supply cancel each other out when they are added together. The choice of a time unit and geographical unit in the model must therefore be carefully substantiated.

## Sources of welfare: the natural gas value chain

As a first step in the welfare analysis, the different sources of welfare in the value chain must be identified. The natural gas value chain can be divided roughly into six different activities, each with its own specific points of attention and impact on welfare in other parts of the value chain.

1. Exploration & production: the first thing that catches the eye when looking at the E&P-sector from a welfare perspective, is that most producers are non-EU entities. This means that their welfare has little weight when optimizing total EU welfare. This in turn means that conventional economic wisdom on optimal market structure does not always apply, and this opens up the possibility of alternative policies that would normally not be considered on welfare grounds.
2. Consumption: consumers are the ultimate beneficiaries of most regulation. The assumption is that allocative efficiency reduces prices for consumers. In addition, the use of the price mechanism to balance demand and supply should enhance the security of gas supply. At the same time, the autonomous development of gas demand is one of the main uncertainties in the market. Welfare analysis must take this into account. In particular, gas demand for power generation and for space heating can develop along different trajectories depending on climate policy both on a European level and on a national level.
3. Transport & distribution: the regulation of transport has been one of the main foci of regulation over the last ten years. Regulation is highly detailed and aims at providing non-discriminatory access to networks and increasing interlinkage of national markets into regional zones. While the welfare contribution of transport companies itself is relatively small, they play a pivotal role in determining the welfare of producers and consumers. Distribution is considered to be downstream and is placed out of scope by the European Commission (EC, 2016).

4. LNG liquefaction, transport and regasification: LNG liquefaction takes place mainly in producer countries and is therefore of relatively small importance for this analysis. The role of LNG regasification, on the other hand, is crucial to the functioning of the European market. It is an essential facility for producers wishing to deliver their LNG to European markets. The question of third party access to regasification facilities is therefore of great importance (Wood, 2016).
5. Storage: either in the form of abandoned gas fields, salt caverns or other, more or less the same applies to storage as to LNG regasification. They are a form of infrastructure essential for balancing supply and demand and they must therefore be available to all interested parties. Since storage facilities are more common than LNG regasification facilities and have a longer history, they have received fewer exemptions. However, the depletion of EU gas fields has and will continue to generate additional demand for storage. This makes the regulatory treatment of storage facilities equally relevant.
6. Trade: trading companies are the necessary complement to unbundled transport companies. Their role is to ensure that the available natural gas arrives at the location where it is valued most highly. Most network regulation is in place to facilitate their activities. The liquidity of trading hubs is also seen as a measure of a trader's ability to perform its activities (Huygen et al, 2009).

Another important aspect to consider is that these six activities are not conveniently divided over independent companies. Activities are often combined into a single company by means of vertical integration. Common combinations of functions are:

- Production & Trade: gas producers often extend their business midstream and even downstream to supply end consumers. This enables them to reap the benefits of trade and diversify their risk exposure to different pricing constructions (Clingendael International Energy Programme, 2008).
- Production & LNG: for producers not linked to the EU market by pipeline, LNG regasification facilities are necessary to gain access to the market. The availability of regasification capacity therefore determines the long term strategy of producers and branching out into the business of LNG regasification can be a sensible strategy.
- Consumption & Trade: large consumers of natural gas do not want to be fully dependent on suppliers and therefore set up their own trading arm to secure the best purchase conditions.
- Transport, Storage & LNG: infrastructure companies see the exploitation of different types of infrastructure as a natural fit with their existing business. Therefore, pipelines, storage facilities and LNG regasification facilities can all be part of an infrastructure company's portfolio.

These combinations are relevant to the welfare analysis, because the combined welfare functions may not be straightforward additions of the individual functions.

Taking the above into account, the monetary value of a certain market outcome can be measured for all market participants involved. Added together, these amount to a welfare measure for the European Union as a whole. The comparison of this welfare measure between outcomes is the main instrument for determining an optimal market structure.

## The optimal structure of the natural gas market: promising research areas

The number of different market structures which can be investigated in a single study is limited. Therefore, it is necessary to start with some hypotheses on the areas where benefits from regulatory change can be expected. In this chapter, we identify four areas of research that we consider to have the most potential for increasing welfare.

The natural gas market can be likened to a three-layered construction. The basis consists of the supply and demand for gas. The second layer is the totality of infrastructure (transport, storage, LNG-regas) which must be available to connect supply and demand reliably. The top layer consists of all trading activity that takes place to optimize the use of infrastructure and the allocation of gas supplies. Each of these layers has some potential for improvement. These improvement areas are discussed below.

First, we turn our attention to supply and demand. Given that the production of natural gas predominantly takes place outside the EU, the EU natural gas market should be as competitive as possible. This ensures welfare is concentrated at the consumer side rather than the producer side of the market. How can this be achieved? Mainly by attracting as many producers to the market as possible. This means making the market attractive to producers, without hindering competition. A number of options can be explored to achieve this:

- Allowing producers to build their own LNG regasification installations and storage facilities without requiring third party access;
- Guaranteeing producers access to regasification capacity, transport capacity and storage capacity for longer periods, e.g. by allowing them to book firm capacity for a period of their choosing;
- Allowing producers to close long term supply contracts with consumers and/or traders against favorable conditions (but without destination clauses).

Second, we look at infrastructure. To maximize welfare, infrastructure should be dimensioned optimally. The main tradeoff involved is that, on the one hand, infrastructure capacity should be large enough to accommodate gas flows. On the other hand, it should not be excessive so that users are charged unnecessary costs. To ensure optimal dimensioning, investors must take into account all social costs and benefits in their investment decision and be handed the tools to achieve their goals. See also Brunekreeft et al (2004), for an overview of the issues involved. Areas of interest include:

- Limiting the pass through of costs by network operators to consumers. This prevents network operators from overinvesting and then passing the costs of underutilization on to consumers. It also limits the need for regulatory authorities to judge the need for additional capacity substantively.
- Allowing the forward sale of capacity for the period of time required to recoup the investment, for instance using 'open seasons'. After this period, third party access can be enforced.

- On its own, limiting cost pass through may lead to underinvestment. However, a mixture with forward sale may provide both infrastructure companies and trading companies with the certainty they require.

Third, traders should be enabled to optimize their arbitrage possibilities using transport, storage and commodity contracts, while bearing both the risk and the profit of their activities. The options identified above should facilitate trading too. In addition, further market integration increases welfare by enlarging the scale of the market and optimizing allocation over different submarkets. It can also improve the security of gas supply by increasing diversity (Austvik, 2016). As already indicated by the Commission, possible regulatory changes in this area are:

- An increase in the integration of markets by the merger of market zones;
- The removal of tariffs for intra-EU interconnection points.

## Conclusions

This paper has provided some ideas on how to maximize EU welfare by optimizing the regulatory framework of the EU natural gas market. The focus of this paper has been the optimal regulatory end state of the natural gas market within the paradigm of market liberalization, leaving aside issues of the pros and cons of regulatory intervention per se.

Measuring the welfare obtained from the natural gas market is a complex affair, because competitiveness and supply security must both be taken into account. This requires a non-standard approach. This paper suggests the combined use of traditional welfare economics, benchmarking, stress tests and qualitative analysis.

After a brief sketch of the natural gas value chain and the sources of welfare found therein, the paper ends with some pointers on remaining optimization potential in the natural gas market. Three main areas of interest are described: attracting more and more diverse supplies of gas to the market, optimizing the tradeoff between stimulating investment in infrastructure and controlling costs, and facilitating trade by increasing the integration of European submarkets.



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