



LDP Academic Roundtable Redesigning Gas and Electricity Markets to Work Together

Authors: Arthur Henriot, Miguel Vazquez, Michelle Hallack, Jean Michel Glachant

Highlights

- Due to the significant role already played by gas-fired power plants and the ongoing integration of renewables into the existing network, the relationship between the gas and electricity markets is becoming ever closer. As a result, we must consider if the existing gas and electricity market designs can cope with these changes or whether some market redesign is required in gas, electricity or both.
- The decision to invest and trade is dependent on existing market designs, particularly concerning trade timeframes and geographical zones. A design which is too weak may create the possibility of cross-subsidies between time or space flexible users and inflexible ones within each of the gas or electricity market design and between them.
- With an increasingly close relationship between gas and electricity market designs, the role of the TSOs may have to evolve. If transmission networks are facing a higher industry-specific or cross-industry demand for flexibility, increased coordination between operation and planning may be required from both gas TSOs and electricity TSOs.
- Whether the current electricity generation is adequate depends increasingly on the current conditions of access to natural gas. If gas is to play such a significant role in the security of electricity supply, compatibility between long-term arrangements in gas and in electricity markets must be ensured.

Florence School of Regulation

The Florence School of Regulation (FSR) was founded in 2004 as a partnership between the Council of the European Energy Regulators (CEER) and the European University Institute (EUI), and it works closely with the European Commission. The Florence School of Regulation, dealing with the main network industries, has developed a strong core of general regulatory topics and concepts as well as inter-sectoral discussion of regulatory practices and policies.

Florence School of Regulation
Robert Schuman Centre
for Advanced Studies

European University Institute
Villa Malafasca
Via Boccaccio 151
50133 Firenze - Italy

Contact FSR coordinator:
Annika.Zorn@eui.eu

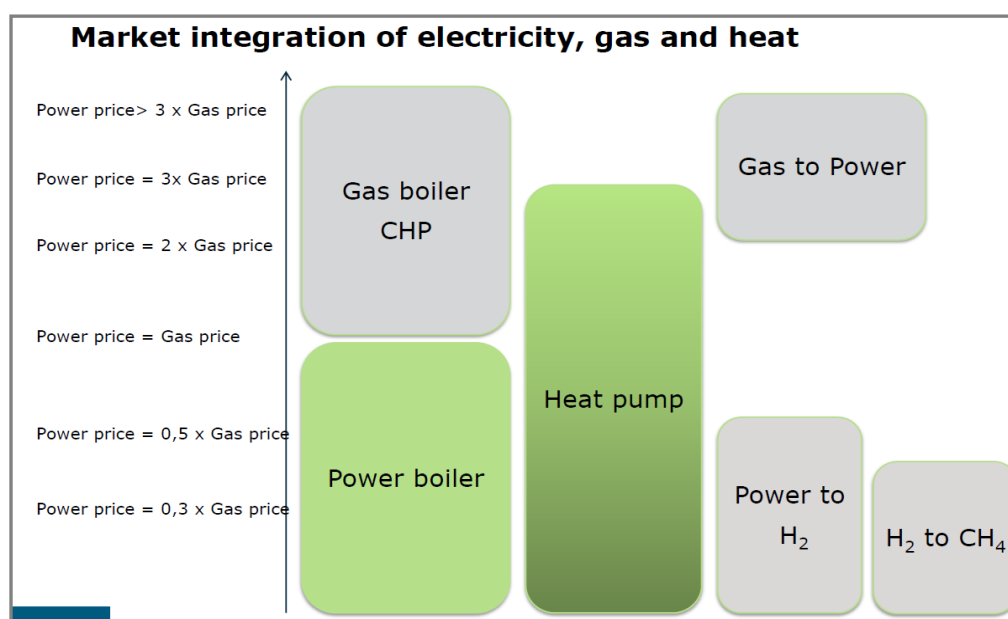


Figure 1: Market integration of gas, heat, and electricity (source: Energinet)

Background

The interaction between gas and electricity markets is not a new phenomenon. Gas and electricity can be competitors, for instance, when a consumer is to install a boiler; but gas can also be an input for gas-fired power plants (GFPPs) to generate electricity as long as the spark spread is high enough (See Figure 1).

This interaction becomes, however, increasingly significant in a context of large-scale development of variable renewable energy sources (RES). GFPPs indeed appear as the technology that is most likely to provide the flexibility needed to cope with the technical challenges introduced by variable RES in power systems.¹

Gas and electricity have very different physical properties. Gas flows more slowly than electricity, and is also much less expensive to store. Moreover, gas systems feature inherent flexibility thanks to linepack storage. The **balancing** in gas systems is therefore less challenging than in power systems. Consequently, the way markets have been defined in both industries is very different. It is still considered by many today that the two industries should be addressed independently.

However, if the demand for flexibility in electricity markets is to be met by flexibility in the gas markets, **coordination between gas markets and electricity markets will be needed both in the short-term and in the long-term.** In the short-term, the choice of consuming gas to generate electricity, for instance, in case of

imbalances in the electricity market, will be made depending on the corresponding opportunity-costs and technical constraints. In the long-term, electricity transmission investments can for instance be a substitute for gas pipelines, which then strongly impacts the location of power plants and gas storage assets.

Short-term interactions between gas and electricity markets

Issue 1: Is harmonisation between the gas and electricity industries required or do the existing market differences simply reflect different technical realities?

Most of the flexibility provided by gas markets is not priced to **the gas network users who then do not perceive the flexibility costs.** Some might argue that GFPPs are simply another consumer of gas and that their needs will be met naturally. This implies that the gas system always responds to the new needs born inside the electricity system. However, the markets taking place in gas and electricity are not based on the same set of rules. The time and place of delivery matter for a gas consumer or an electricity consumer, and the way **time frames and geographical zones** are defined will therefore impact the behaviour of these players. **Price-signals** associated with this flexibility depend in turn on the definitions of those zones.

In the European Union (EU), **simplifications** have been introduced with the aim to enhance competition and market integration: **intra-zone constraints** are not fully considered while **inter-zone constraints** are taken into account with imprecise

¹ For more details, see IEA(2012): The Impact of Wind Power on European Natural Gas Markets.

proxies. These simplifications result in misguided behaviour and hence efficiency loss. In addition, the zones are defined following political realities that often do not match physical realities. Decisions to invest and trade are taken based on these sets of institutionally-established zones. Distortions could occur within the gas sector and the electricity sector but also in-between both industries.

Issue 2: Will the current market frameworks allow trading in a flexible way? Does a new context require a new market design? Should balancing responsibility be increasingly transferred from TSOs to participants?

As most of the existing schemes were designed to handle large and stable flows of gas and electricity, they might be challenged in a more volatile environment. The simplifications put into place by market designers do inevitably determine **the business-models for flexible generation assets**, storage assets, and transmission assets. Relying on simplifications leads to **cross-subsidies** between flexible users and inflexible ones inside each industry and across them. In any simplification of a market, there is a trade-off. One option is to expose all participants to each category of costs that they generate and to reduce the socialisation created by the improper definition of trade timeframes and market zones. From the viewpoint of the gas market, decreased socialising comes with the possibility for users to reveal their preferences on flexibility. Another option is the exact opposite, which is to enlarge or simplify trade horizons and market zones. This calls for an easing of access to flexibility within the energy system(s) and to socialising the costs created by longer timeframes and larger zones.

In certain gas market design, the short-term market (as within-day) does not exist yet. This “missing market” is key in understanding the short-term interaction challenges between gas and electricity.

Long-term interactions between gas and electricity markets

a) Coordination of investments

Issue 3: Is the current level of coordination between gas and electricity TSOs sufficient to ensure delivery of the needed investments?

Assets involved in the transmission of gas and power, as well as generation assets, feature high capital costs and long life expectancy, and they require long planning delays and long construction times before operating. **Investment decisions** are therefore strongly affected by uncertainty regarding the future environment. In particular, the profits generated by an asset are impacted by the investment decisions taken by other players, both within the same industry and in the other industry. Figure 2 illustrates the case of two competing investments that are mutually exclusive.

Transmission assets owners in Europe are regulated; their remuneration depends on the approval of a national regulatory authority. The **planning of investments** is then decided at a national level, generally proposed by the TSO and approved by a national authority. As the relationship between the power sector and the gas sector becomes increasingly significant, the **coordi-**

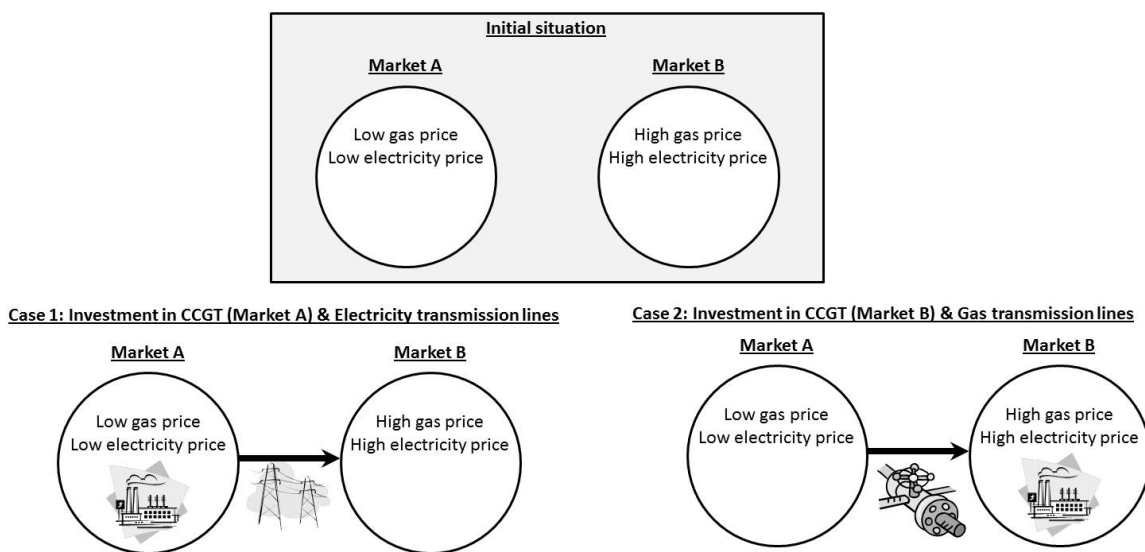


Figure 2: Illustration of mutually exclusive investments

nation level between Transmission System Operators (TSOs) in the gas and electricity sector should increase as well.

Issue 4: How are the distortions between price-signals received in the gas and the power sector impacting the investment decisions made by participants?

Distortions in short-term price-signals affect long-term decisions taken by the participants. If the network system flexibility can be used for free, network users will not have enough incentives to invest in other kinds of flexible assets. If the price-signals received by participants in one of the industries do not reflect the real characteristics, misguided investment decisions will lead to inefficiency across both industries.

Issue 5: How to ensure that TSOs receive the adequate incentives to invest and efficiently operate these new assets? Can the old model adapt to this new role of the TSOs? Are there any competition issues regarding the operation of flexibility assets by TSOs?

The **role of the TSOs** will have to evolve if transmission assets are used to deliver a **high amount of flexibility**. Gas TSOs can for instance offer more line-pack capacity but this will reduce the available transportation capacity; electricity TSOs might have to invest in storage capacities (as it is already the case in Italy) or in demand response. It is not clear today how TSOs will deal with **conflicting incentives** between the need of an efficient operation of the network and the existing regulatory frame governing the ownership of various assets able to deliver flexibility.

b) Long-term contracts and security of supply

Issue 6: How can compatibility of long-term security of supply in the power and in the gas systems be ensured, for instance, at times of difficulties in both? Should gas arrangements be driven by power system reliability?

Gas can play a significant role in long-term security of supply of electricity. As gas is cheaper to store than electricity, the amount of energy stored in gas storages is much higher than the amount of energy stored in electricity storage (see Figure 3). Similarly, energy can be transferred between two countries through cross-border gas transmission or electricity transmission.

However, there might be some tensions in case of **difficulties in gas or electricity or both**. What would the status of GFPP electricity producers then be compared to the other gas consumers: should the gas flow to generate electricity or for more specific gas uses? What if long-term contracts to supply GFPPs are disturbed due to political choices restraining the use of gas?

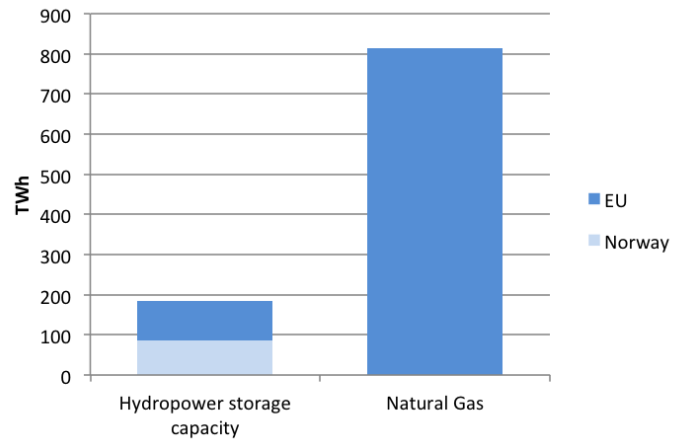


Figure 3: Energy Storage capacities in Europe (source: Energinet)

Issue 7: Will new kinds of gas supply contracts emerge when needed or are there any barriers to their development? Does the lack of adequate gas supply contracts constitute a barrier to entry in the generation sector?

Gas supply contracts may have many dimensions, such as firm versus interruptible, rigid versus flexible, short term versus long term, etc. An important issue is the need for **gas contracts that are both long-term and flexible** for GFPPs operating as back-up units. The existing supply contracts have not been designed for flexible power production. However, flexible contracts may allow consuming a maximum amount of energy per year without any constraint on the consumption pattern.

Moreover, it is worth underlining that the incompatibility between gas and electricity usages and arrangements may appear with transmission contracts. While cross-border gas supply is based on long-term network contracting, power markets do not allow **long-term reservation of capacity**. In case of cross-border paths, both the gas and the electricity interconnections should be explicitly taken into account in long-term contracts and left to short-term implicit allocation.