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Commentary

What to Expect from the 2020 Gas Package

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Abstract
Gas is considered an important part of the European Union's (EU) energy mix. Making up a quarter of the energy consumed in the EU, it is widely used by both households and industry. Gas supports the penetration of intermittent renewable electricity and is considered the cleanest of the fossil fuels but its combustion emits a considerable amount of greenhouse gases. In the fight against climate change, the EU has committed itself to the near-complete decarbonisation of the energy sector well before 2050. This will have a significant impact on the gas sector, especially in the EU, which has well-developed gas transportation and storage assets. This commentary examines two potential pathways that could enable the gas sector to contribute to the EU's decarbonisation efforts while continuing to play a substantial role in the EU's energy supply. The pathways include gas and electricity sector coupling and the substantial increase of renewable gas production. Those options, which are not mutually exclusive, provide an opportunity for the gas sector to thrive in a decarbonised energy future. In some cases, it could require changes in the EU's gas legislation, these changes were announced by the European Commission to be proposed in 2020.

Keywords
carbon capture use and storage; decarbonisation; energy; energy supply; European Union; gas; power-to-gas; renewable gas; sector coupling

Issue
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1. Introduction

Trilogue negotiations on the Clean Energy Package (CEP), published in November 2016, have come to an end. In mid-December 2018, European Commission, the Council and the European Parliament finally reached a political agreement on the outstanding pieces of legislation. The CEP focuses on three areas: energy efficiency, renewable energy generation and the consumers' role in the energy transition. It aims to provide a set of principles which enable the electricity market to respond to the challenges stemming from the increase of variable renewable energy (VRE). This increase is unavoidable if the European Union (EU) is to achieve at least 40% CO2 reductions by 2030.

The CEP is different from the three liberalisation packages that came before it. The previous packages set the principles of the functioning of the internal electricity and gas markets, where legislative frameworks regarding both sectors have been negotiated in parallel. The CEP, on the other hand, is focused on the power sector, and is not comprised of a single piece of legislation addressing the organisation of the gas market. Does this mean that gas will not play any role in the EU energy transition? The answer to this question is that gas could continue to play a major role in the EU's energy supply, but it needs to adapt to the decarbonisation challenges.

To achieve the Paris Agreement targets, the EU needs to reduce its greenhouse gas (GHG) emissions by 80–95% by 2050. With the gradual phase-out of coal power plants, the emissions reductions resulting from coal-to-gas switching in power generation will diminish. As a result, the additional GHG reductions will need to "come from within the gas sector" (Spijker, 2018), which currently generates 66 gCO2-eq./MJ, that is 9.7 gCO2-eq./MJ for gas supply and 56.2 gCO2-eq./MJ for gas combustion (Joint Research Centre [JRC], 2017).

The GHG emissions in the gas sector will not reduce automatically. According to the TYNDP 2018 Scenario Report prepared jointly by European Network of Transmission System Operators for electricity (ENTSO-E) and gas (ENTSOG), EU gas demand will not change dramatically (ENTSO-E & ENTSOG, 2018a). The ENTSOs expect the annual gas demand to stay in line with or be lower than the historic demand average (5,000 TWh) and account for around 3,900–5,000 TWh in the 2040 perspective. However, there is high uncertainty regarding the gas demand after 2050. Additionally, unless the CO2 produced by burning the natural gas can be compensated by further mitigation, decarbonisation beyond 70% would effectively prohibit the use of natural gas. (Hecking & Peters, 2018). For this reason, some projections foresee a steep decline in the EU gas demand (Szeles, 2018).

For the gas industry, the potential GHG abatement options include sector coupling through Power-to-Gas technology, renewable gases and Carbon Capture Use and Storage (CCUS). These potential pathways are at the top of the political agenda in Brussels and important regulatory meetings such as the Madrid Forum (European Commission, 2018).

The following two sections will focus on sector coupling and renewable gases, currently in the spotlight as key technological pathways allowing gas to contribute to the EU decarbonisation efforts. The third part will dig into the positions and preferences of some of the key actors involved in the discussions. The commentary will conclude with potential changes that may constitute a part of the new gas package to be released by the upcoming European Commission in 2020.

2. Sector Coupling and Hydrogen Technologies

The concept of sector coupling (SC) is defined as "co-production, combined use, conversion and substitution of different energy supply and demand forms—electricity, heat and fuels" (International Renewable Energy Agency [IRENA], International Energy Agency, & REN21, 2018, p. 93). In the EU context, it is generally understood as a closer integration between the electricity and gas sectors, with respect to both markets and infrastructure, allowing for the integration of the rising share of renewable energy on the one hand, and to decarbonise the final use on the other. However, the lack of an EU-wide definition of sector coupling is the first challenge that the new gas package should address.

In practice, SC allows the use of excess electricity from renewable sources to produce green hydrogen and synthetic methane via electrolysis and methanation, respectively. Renewable hydrogen could replace traditional hydrogen production, which is almost exclusively (95%) fossil-fuel based (IRENA, 2018). The process of converting renewable energy into carbon-free gas, liquids and heat is referred to as Power-to-Gas (P2G), Power-to-Liquid(s) (P2L) and Power-to-Heat (P2H).

This technological solution offers many advantages and solves some key energy transition dilemmas. Firstly, as our energy system becomes increasingly dependent on the generation of variable renewable energy, the technologies enabling the integration of a rising share of intermittent energy and energy storage are needed. Power-to-X technologies offer more flexibility to the energy system and are cost-competitive with alternative technologies such as demand side response, grid expansion or electricity storage (batteries), especially when the share of renewable energy comes closer to 40 or 50% (Göransson & Johnsson, 2018).

Secondly, SC allows the continued use of natural gas infrastructure for the benefit of energy consumers. Otherwise, part of the infrastructure would need to be decommissioned, in some cases before the return on investment is achieved or prior to the end of its economic life, leading to the problem of stranded assets. In recent years, public finance was used to support the construction of gas infrastructure with the objective to enhance security of supply and to establish a well-functioning European gas market. Using existing energy transport and distribution infrastructure is not only cost-efficient but should also be recognised as a secure strategy in the transition to a decarbonised energy future (Agency for the Cooperation of Energy Regulators [ACER] & Council of European Energy Regulators [CEER], 2018).

Thirdly, SC could significantly contribute to the EU emission reduction targets, as the green hydrogen and synthetic methane could replace the natural gas in conventional gas turbines, heating and cooling and transport (MacKinnon, Brouwer, & Samuelsen, 2018).

3. Renewable Gases

Another widely discussed decarbonisation pathway for the gas sector is the use of renewable gases or green gases, that is, gases that have similar qualities to natural gas but are produced from organic waste or renewable electricity through the above-mentioned Power-to-Gas process.

Although the costs of solar and wind electricity continue to fall worldwide, creating favourable conditions for producing cheap renewable electricity, the demand is not necessarily there. The electricity produced could be carried to the consumer centres via Ultrahigh-voltage (UHV) lines. Alternatively, the electricity could be used to produce renewable gas, which could be carried by existing pipelines or Liquefied natural gas (LNG).

Through electrolysis, electric currents split molecules of water to produce hydrogen and oxygen. The hydrogen can then be used in transport, mingled in small quantities with the natural gas in gas pipelines, or it can be used to produce synthetic natural gas (SNG) via methanation. Technology costs decrease substantially with increased production.

The second type of green gas is biogas. It is produced from the organic waste of varying origins, including the food industry, agriculture or municipal solid waste, through anaerobic digestion. Biogas usually consists of methane (40–70%), carbon dioxide (30–60%) and various contaminants (ammonia, water vapour, hydrogen sulphide, nitrogen, oxygen, etc.). Biogas is used on the spot to generate power and heat, or it is purified and upgraded to biomethane that can be injected into the gas grids. Injected biomethane has the same applications as traditional natural gas and is used by the industry, in the residential sector or to produce electricity.

The continued replacement of natural gas with renewable gases offers many benefits, mainly the reduction of GHG emissions. The uses of renewable gas could also boost the (seasonal) flexibility of the whole energy system. Furthermore, it gives the chance to use the existing gas infrastructure. However, the increase in renewable gas production will partly depend on the gas sector's effectiveness in minimising methane emissions.

Currently, there are roughly 500 biomethane plants (Gas Infrastructure Europe & European Biogas Association, 2018) and over 50 Power-to-Gas projects in Europe (Vartiainen, 2016). Although they are readily available, all renewable gas technologies require political and regulatory support to decrease the costs of investment and production, thus playing a more prominent role in the energy transition (Schmidt et al., 2017).

4. In the Pursuit of Political Support

Thus far, sector coupling has received the broadest political support from the European Commission (DG Ener), ENTSOs, ACER and the majority of the Member States. DG ENER is currently working on a "Study on sector integration" that aims to identify potential regulatory barriers and gaps preventing the integration of electricity and gas. The study will conclude with recommendations regarding legislative measures which enhance the removal of regulatory barriers and close gaps in the current regulation, with a focus on the 3rd Package's elements (mainly Regulation (EC) No 715/2009 and Directive 2009/73/EC). The final report will be published in April 2019 (Szeles, 2018).

ENTSO-E and ENTSOG gave concrete support to Power-to-Gas technology. In a joint paper released on the eve of the Madrid Forum, Transmission System Operators emphasised the need to significantly increase the current P2G capacity so that it achieves the GW-range by the early 2030s (ENTSO-E & ENTSOG, 2018b). This should be done through the upscaling process of P2G facilities, at least by a factor of 10, increased research and a demonstration of Power-to-Gas plants grid supporting capabilities. Moreover, the ENTSOs called on electricity and gas TSOs to cooperate and to take the lead in developing the technical requirements for system integration of P2G facilities. Despite the fact that the ENTSOs referred to biomethane and decarbonised gas as "valuable energy carriers", they do not call for any concrete measures aimed at the increase of renewable gas or decarbonised gas production.

In contrast to the EU Commission and the ENTSOs, ACER is more cautious. Although ACER considers finding synergies between the gas and power sector as a significant challenge and describes Power-to-Gas as a valuable technology due to its energy storage capacity, it refrains from using the term sector coupling. ACER instead supports renewable gases and the use of the existing gas infrastructure to accommodate its growth potential (ACER & CEER, 2018).

Member States remain divided on this issue. Austria, which held the rotating Presidency of the Council of the EU in the second half of 2018, put hydrogen technologies on the agenda of the informal meeting of energy ministers, which took place on 17–18th September 2018. During the high-level energy conference preceding the informal ministerial meeting, the invited politicians, researchers and business representatives debated the outcome of renewable hydrogen projects and their potential to scale up. However, only 25 out of 28 Member State representatives signed under the non-binding Hydrogen Initiative aimed at promoting the potential of hydrogen, which indicates a lack of consensus among the EU Member States on the issue (Taylor, 2018). The P2G is of particular relevance for the countries with well-developed gas infrastructure and a high share of intermittent renewable electricity. For this reason, it is difficult to expect that countries with low wind and solar energy production and under-developed gas infrastructure would be interested in investing in P2G facilities (Speirs et al., 2017).

At this time, the European Parliament has not expressed its official position on sector coupling. However, it began investigating the topic with the publication of a study on sector coupling at the request of the Committee on Industry, Research and Energy (ITRE Committee; van Nuffel, Gorenstein Dedecca, Smit, & Rademaekers, 2018).

5. Conclusions

Future gas regulation will be increasingly affected by environmental concerns and climate change policy objectives. The new role of the gas sector, emerging from current discussions, is highly intertwined with the electricity sector. Using gas as a source of seasonal flexibility and as a buffer to absorb excess variable renewable energy is not only the most economical pathway but is also potentially the most politically acceptable option for EU Member States and consumers. Therefore, sector coupling combined with the production of hydrogen and the generation of renewable gases seems to be the only credible decarbonisation option in several industrial activities due to the lack of alternative technologies.

Assessment of the current discussions suggests that the 2020 Gas Package:

- will develop a clear vision on the role of gas up to 2050 and will most likely propose renewable gas and decarbonised gas targets, whether they will be binding or non-binding targets remains to be seen;
- the vision will build upon the Third Energy Package (Regulation (EC) No 715/2009 and Directive 2009/73/EC) and the developments of the CEP (inter alia Recast Renewable Energy Directive, Directive 2018/2001). The synchronisation of the unbundling framework for electricity TSOs (Recast Electricity Directive, COM/2016/0864 final) and gas TSOs, which could allow them to operate the Power-to-Gas facilities, would be a key challenge as TSOs are among the key advocates of P2G;
- to enhance the cross-border trade of renewable gases will introduce a system of EU-wide certification or guarantees of origin through the revision of the Renewable Energy Directive (Directive 2018/2001);
- will address barriers related to gas quality and injection tariffs for renewable gases inserted into gas grids;
- will introduce integrated electricity and gas market design, e.g. by allowing conditional electricity and gas bids.

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Conflict of Interests

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