

Decarbonising the Gas Sector: is Renewable Gas a Serious Option?

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Highlights

- Today, natural gas provides one quarter of the EU's energy supply. The EU has a well-developed gas network and skilled people to operate and trade the gas. Using natural gas as a fossil fuel produces significant GHG emissions. Because of that the gas sector should engage in the EU's decarbonisation efforts. One of the most politically acceptable and economically viable ways to decarbonise the gas sector is to inject renewable gas into the existing gas networks.
- The EU has considerable experience in the production and use of renewable gas. The current schemes have mostly supported its use on the spot, mainly for electricity generation, and only a small share has been injected into the gas grid. The experience of the injection has been positive and in most cases increases the value of using renewable gas. However, the considerable increase of renewable gas production is not possible without concrete political support and addressing the cross-border issues stemming mainly from the differences in national legislation on gas quality.
- Policy instruments for renewable gas support. The recast of the Renewable Energy Directive (2009/28/EC) provides for positive development of renewable gas, however it still falls short of meeting the gas sector's decarbonisation challenge.
- To enable a real change a target for renewable gas in the European gas grid for 2030 should be established, indicative trajectory designed and the Energy Union's governance procedure used to undertake corrective actions, if necessary.
- The renewable gas support schemes should encourage the production of the renewable gas with one of the goals regarding its injection in the gas grid.
- Dealing with obstacles to cross-border trade. The Network Code on Interoperability and Data Exchange rules seems satisfactory to avoid cross-border trade restrictions resulting from the gas quality differences.
- EU benchmarks on odorization and control processes should be established to facilitate cross-border trade.
- Harmonisation of the Guarantees of Origin (GoO) certification system should facilitate the uptake of renewable gas in the grid.



1. Introduction

The spring of 2017 marked ten years since European leaders reached an agreement on climate and energy objectives. The adoption of the so-called 20/20/20 targets, which were based on three pillars – the reduction of GHG emissions, deployment of renewable energy and energy efficiency – began a new chapter in the European Union’s climate and energy policy. Ten years on, the Union *en bloc* is well on track to meet those objectives, with 17 Member States having already met their national targets in all three areas¹. Nevertheless, achieving the 2030 and subsequent targets is proving to be a bigger challenge.

In order to meet the Paris Agreement objectives, the EU is required to reduce its emissions by 80-95% by 2050. This implies that the EU energy system, and necessarily the gas system, need to be decarbonised over the course of next three decades. However, today the generation of 1 MWh of electricity from natural gas produces 200 kg of CO₂, and overall the current level of gas consumption creates more than 700 MtCO₂e emissions².

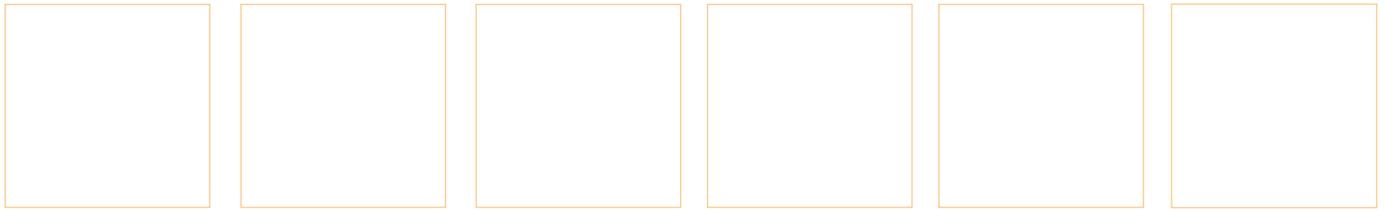
At the same time, for security of supply and market integration purposes the EU continues to support, and in some cases to finance, the construction of the new natural gas infrastructure. The latest list of the Projects of Common Interests (PCIs) proposed by the European Commission in November 2017

includes 173 PCIs, of which 53 are gas projects³. The list prompted vocal opposition, on the grounds that the continued spending on fossil fuels infrastructure is in conflict with EU climate policy objectives⁴ and may lead to the problem of stranded assets⁵. The argument that natural gas is a cleaner alternative to other conventional fuels and may serve as a back-up to intermittent renewable power production is being questioned, especially in the long-term perspective⁶.

The current models for the future role of gas in the EU energy system anticipate a steady gas demand. The CEER Report ‘Study on the Future Role of Gas from a Regulatory Perspective’ even in the low demand scenario case expects a demand of more than 400 bcm in 2035⁷. That makes a gas sector decarbonisation a real challenge. The options for the decarbonisation could be CCSU (Carbon Capture Storage and Use), increased use of renewable gases in place of natural gas, and carbon offsets by other actions (forestation etc.). An additional challenge is that measures taken shouldn’t undermine the internal gas market functioning. From a political acceptability point of view, the increased use of renewable gases seems the easiest option for gas system decarbonisation.

By the term ‘renewable gas(es)’, known also as green gas, the authors understand: biogas and biomethane produced via anaerobic digestion, synthesis gas (syngas) generated through gasification and

1. See: European Environment Agency, Trends and projections in Europe 2017. Tracking progress towards Europe’s climate and energy targets. EEA Report, No 17/2017, p. 14.
2. ENTSOG [Ten-year network development plan \(TYNDP\) 2017. Main report.](#), p. 90 and p. 92.
3. [Commission Staff Working Document](#) accompanying the document Commission Delegated Regulation amending Regulation (EU) No 347/2013 of the European Parliament and of the Council as regards the Union list of projects of common interest. C(2017) 7834 final, p. 2.
4. Claude Turmes, ‘The future of gas is not fossil but green’, Euractiv, 20 February 2018.
5. Danila Bochkarev, ‘“Projects of Common Interest”, or waste of public resources?’, Euractiv, 8 February 2018.
6. Jonathan Stern, The Future of Gas in Decarbonising European Energy Markets: the need for a new approach, OIES Paper, NG 116, p. 6.
7. CEER [“Study on the Future Role of Gas from a Regulatory Perspective”](#), Ref: C17-GPT-04-01, 6 March 2018, pp. 54-55.



hydrogen and synthetic methane created via Power-to-Gas (P2G)⁸.

This paper is structured as follows: the first part provides an overview of the EU experience with renewable gas and the projected potential of renewable gas production in 2030 perspective. In subsequent sections, the authors explain the major policy and cross-border barriers preventing the penetration of renewable gas in the EU energy mix. In the context of the current discussion on the role of gas in the future EU energy mix, this paper proposes some ways in which, according to the authors, renewable gas penetration in the EU's gas market might be boosted that will be followed by conclusions.

2. Renewable Gas Experience in the EU

Renewable gas is still a marginal energy carrier in Europe, accounting for 4% of the entire gas market in the European Union⁹. Moreover, the pace of growth of renewable gas production has been gradually declining since 2011 (22.4% in 2011, 17% in 2012, 14.3% in 2013, 7.3% in 2014, 4.2% in 2015 and 3% in 2016). Most renewable gas is produced in the form of biogas and is used locally to generate heat and power. However, between 2011 and 2016 biogas electricity generation has almost doubled from 35.9 TWh to 62.5 TWh. The majority of biogas (74.1%) is produced via an anaerobic digestion process from non-hazardous waste and raw plant matter. The rest is landfill biogas and gas from wastewater treatment

plants. Only a small part has been upgraded to biomethane and injected into the gas grid¹⁰.

Some EU Member States, such as Germany, Italy, France, the UK and Scandinavian countries have accumulated ample experience in the production and use of green gases. The utilisation of green gas has demonstrated additional benefits to low level of GHG emissions – empowerment of local communities, job creation in rural areas, and the reduction of emissions in agriculture. Biogas can be derived from various, locally-available feedstock. It is fair to say that the experience of renewable gas has shown that its production and use has clear environmental and social benefits¹¹.

There are many reasons why the penetration of renewable gas is so limited. Most importantly, so far, renewable gas has been seen as a marginal renewable energy source, mainly as a form of support to rural communities. The task has never been to decarbonise the whole gas sector. Technology challenges are not fundamental, apart from the technologies involved in transforming woody biomass into green gas and Power-to-Gas that need additional investments to improve the cost/value performance. The question of feedstock is also important, especially given the difficult experience with biofuels¹². Complicated administrative procedures delayed or cancelled some of the planned investments. Low carbon price and inconsistent support policy is also to blame¹³. At this stage, cross-border issues played a limited role, but there is already a case that demonstrates a need to address

8. Green Gas. Facilitating a future green gas grid through the production of renewable gas. IEA Bioenergy Task 37, 2018:2, p. 5.
9. Frédéric Simon, Gas lobby chief: 'In 2050, 76% of gas could be renewable', Euractiv Special Report, 25-30 October 2017.
10. Biogas Barometer 2017. EurObserv'ER, 2017. Available at: <<https://www.eurobserv-er.org/biogas-barometer-2017/>> (consulted on 03/04/18).
11. For more information see: ECOFYS Study: Gas for Climate. How gas can help to achieve the Paris Agreement target in an affordable way, 15 February 2018, pp. 16-19.
12. A.K.P. Meyer, et al., Future European biogas: Animal manure, straw and grass potentials for a sustainable European biogas production, Biomass and Bioenergy (2017).
13. CE Delft, Eclareon, Wageningen Research Study: Optimal use of biogas from waste streams. An assessment of the potential of biogas from digestion in the EU beyond 2020, December 2016, pp. 22-29.



some cross-border challenges, which could hamper penetration of the renewable gas.

As a result, at this stage it is nearly impossible to forecast the share of renewable gas in the overall gas consumption for 2030. In general, long-term gas demand scenarios do not recognise renewable gases¹⁴. Some experts have suggested it could grow to 12-14%, but also that it could stay at the current level of 4%.

The willingness and the direction of the support for the renewable gas installations in EU Member States will play an important role in the growth of renewable gas production.

In March 2018, the European Commission approved a EUR 4.7 billion public support scheme for advanced biomethane and biofuels in Italy. The scheme will incentivise farmers to produce biomethane from manure and other residues originating from their farming activities and to use it in turn to power their agricultural machines and vehicles¹⁵.

In France the objective is to inject 8 TWh of biomethane into the gas grid in 2023, which is forty times the amount injected in 2016. In 2015 the adopted Energy Transition Law for Green Growth expects that renewable gas will provide 10% of France's energy mix by 2030. The production should reach 30 TWh. The ADEME (French Agency for the Environment and Energy Management) has found that

the first injection experiences in the French network are positive. Biomethane injection units are rapidly reaching expected production and reliability levels¹⁶. Economic viability is guaranteed for sites with good technical performances thanks to the feed in tariffs (guaranteed for 15 years).

IRENA (International Renewable Energy Agency) in its study 'Renewable Energy Prospects for the European Union' recognises that biogas represents an interesting alternative for the future supply of renewable energy, and that it could be the solution for flexible power production and an option for the decarbonisation of the natural gas sector¹⁷. Nonetheless, it emphasises that 'The existence, stability and reliability of the policy framework and support schemes appears to be the number one driver in all countries. National targets and goals also are identified as an important driver for the sector'¹⁸.

In IRENA's analysis, the EU could double the renewable energy share in its energy mix, from 17% in 2015 to 34% in 2030 in a cost-efficient way using today's technologies¹⁹. The main drivers with strong cost savings are wind, solar and solar thermal sectors, the use of biomass in power and district heat requires additional costs. Interestingly the study does not consider the intermittency of the renewable electricity as an important challenge. It believes that by strengthening the grid and improving congestion management there should be no major problems. As

14. One of the exceptions is ENTSOG Ten-Year Network Development Plan 2018. In the recently published [ENTSO's TYNDP 2018 Final Scenario Report](#), the share of green gas ranges from 4.5% to 14%, depending on the scenario analysed. In all cases, ENTSOs expect strong biomethane development and that biomethane will form the lion's share of the green gas supply, pp. 14-15.

15. State aid: Commission approves €4.7 billion public support scheme for advanced biomethane and biofuels in Italy, European Commission – Press release, 1 March 2018.

16. Etude 'Un mix de gaz 100 % renouvelable en 2050 ?', conduite par l'ADEME en collaboration avec GRDF et GRTgaz, January 2018.

17. IRENA in cooperation with the European Commission, Renewable Energy Prospects for the European Union, February 2018.

18. *Ibid.*, p. 47.

19. *Ibid.*, pp. 19-22.



a result, the study does not mention Power-to-Gas related issues.

The analysis of the experience of the EU in the production and use of renewable gas shows that in the business-as-usual scenario we cannot expect substantial penetration of green gas in the EU energy mix.

3. Policy Issues

The penetration of renewable gas on the European level has been guided by the Directive on the promotion of the use of energy from renewable sources²⁰. European legislators are finalising the recast of this directive, which will guide the penetration of the renewable energy sources in the EU's energy mix in the period after 2020²¹. There are many elements in the recast that could support stronger penetration of the renewable gas in the energy mix.

The share of the renewable energy sources should reach at least 27% in the final energy mix by 2030²². Administrative obstacles to build and operate RES installations will be substantially reduced with the creation of the 'one-stop-shop' for permit granting processes (Art. 16). Moreover, yearly targets to increase minimum annual shares of the renewable energy sources in heating and cooling and transport will be introduced (Art. 23). Changes in the targets for biofuels will favour an increased amount of feedstock to renewable gas (Art. 26).

There are also gas specific articles, demanding transparency and nondiscrimination in connecting renewable gas sources to the gas network and calling Member States to evaluate the need to extend their grids for the integration of the renewable gas (Art. 15). What is more, the proposed extension of Guarantees of Origin (GoO) to cover renewable gas could facilitate greater cross-border trade (Art. 19).

There aren't any country-specific binding targets. Member States should define their contribution to the achievement of the overall EU target as part of their Integrated National Energy and Climate Plans. The risks of this approach are that opportunities created for the production and use of the renewable gas won't be used and there will be parallel development of the renewable sector and natural gas sector without the decarbonisation of the latter. Such a development would be evidently more expensive for society as a whole. Additional risk comes from patchy developments of the decarbonisation of the renewable gas sector, which will impact the functioning of the internal energy market for gas.

It seems that the decarbonisation effort of the gas sector with the use of renewable gas should be more organised compared with the general approach to the increased use of renewable energy.

The governance process set out in the respective Regulation²³ could be used to agree on the soft targets for the share of the renewable gas in the gas grid. Taking into account the current development, the conservative target could be 12% of renewable gas

20. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/E.

21. Review of the Renewable Energy Directive 2009/28/EC to adapt it to the EU 2030 Climate and Energy Targets. In: [European Parliament Legislative Train Schedule](#) (consulted on 10/04/2018).

22. European Commission, Proposal for a Directive on the promotion of the use of energy from renewable sources (recast), COM(2016)767.

23. Proposal for a Regulation of the European parliament and of the Council on the Governance of the Energy Union, amending Directive 94/22/EC, Directive 98/70/EC, Directive 2009/31/EC, Regulation (EC) No 663/2009, Regulation (EC) No 715/2009, Directive 2009/73/EC, Council Directive 2009/119/EC, Directive 2010/31/EU, Directive 2012/27/EU, Directive 2013/30/EU and Council Directive (EU) 2015/652 and repealing Regulation (EU) No 525/2013.



in the EU gas network in 2030. After agreeing the target one could also anticipate the trajectory of this target. The use of governance procedure monitoring could be established and corrective actions taken.

Even if the approach seems to be very top-down, it has been the best means of moving the EU's policies and targets forward. The success of '20-20-20' by 2020 is a good example. The non-binding nature of the approach could encourage the political support on the part of the Member States. It would be a mistake not to use the EU's well-developed gas grid, worth more than EUR 400 billion, to reach climate objectives²⁴. The serious decarbonisation in the supply chain could help to avoid costly investments in the final use and provide for customers' comfort, as they will be able to use gas, which they were using for years, to satisfy their energy needs.

Looking from the consumers' perspective, the use of hydrogen and synthetic methane generated through Power-to-Gas technology is promising²⁵, even if today's experience is mostly based on biogas. The ADEME 2016 study concludes that hydrogen produced from renewables could provide a serious contribution, in particular in transport and storage²⁶. Also fertiliser production could be based only on the use of 'green' hydrogen. The hydrogen can compete with other technologies, since it provides a similar user experience to already available technologies, with lower impact on the environment, yet it is still

too costly²⁷. If hydrogen is to play an important role in greening the gas grids, innovation and technological advancement will be needed to reduce the costs. There are factors beyond the gas sector like the availability of biomass, availability of green electricity and technological development in Power-to-Gas and woody biomass to gas processes, but even now quite a few measures could be used to provide predictable support for having more renewable gas in the existing gas networks. Favourable tariffs can be set for the renewable gas injected into the natural gas network. Favourable connection procedures could be set for the renewable gas transport to the gas network. It is particularly important to note that research indicates that today's tendency to use biogas for the local electricity production is less efficient compared with the production of biomethane²⁸. Budzianowski demonstrates that biomethane feed-in-premium at a level of 0.03 EUR₂₀₁₅/kWh_f is sufficient to effectively support biomethane production.

The lessons learnt from the renewable electricity support schemes demonstrate that the state aid granted to renewable energy projects must be limited to the 'minimum necessary' for the investment to take place and the potential reduction of investment costs must translate into lower subsidies²⁹. On the other hand, the investors need to acknowledge the inherent risk resulting from the fact that the public support schemes are not immune to the busi-

24. A. Bressand, Renewable gases: The EU energy transition context and some questions to bear in mind, presented at the FSR Policy Workshop 'The Renewable Gas Complex and the European Path to Decarbonisation' (9 April 2018, Florence).

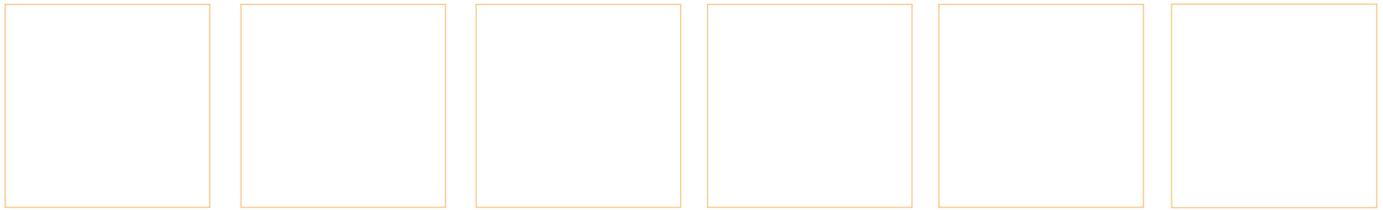
25. Hydrogen is produced via electrolysis (electric current is used to split the molecules of water into hydrogen and oxygen). If the hydrogen is generated from renewable electricity, it is known as 'green hydrogen', in contrast to 'blue hydrogen' (involving the use of CCS technology) and 'grey hydrogen', both obtained from fossil sources.

26. Fiche technique, L'hydrogène dans la transition énergétique, ADEME, March 2018.

27. P. Dodds, Hydrogen markets and challenges, presented at the FSR Policy Workshop 'The Renewable Gas Complex and the European Path to Decarbonisation' (9 April 2018, Florence).

28. W. Budzianowski, D. Budzianowska, Economic analysis of biomethane and bioelectricity generation from biogas using different support schemes and plant configurations, Energy (2015).

29. V. Parail, Lessons from the renewable electricity transition, presented at the FSR Policy Workshop 'The Renewable Gas Complex and the European Path to Decarbonisation' (9 April 2018, Florence).



ness cycle and that the reduction of subsidies, even retroactive, is always possible. That is why the potential support schemes for renewable gas must be carefully designed and the investors need to assess the guarantees provided by governments.

4. Cross-Border Issues

Renewable gas, when injected into the natural gas grid, shouldn't create additional challenges for the internal gas market.

The First ACER Implementation Monitoring Report of the Network Code on Interoperability and Data Exchange signals the first problem case regarding the exchange of biomethane between the Danish and German networks³⁰. Biogas is naturally rich in sulphur and as a result it is quite corrosive. Before the biogas becomes biomethane and is injected into the gas grid, it undergoes the process of the desulphurisation, which consists in the use of oxygen. As a result, the biomethane is low in sulphur, but contains oxygen.

This becomes an issue when the biomethane produced in Denmark crosses the border to Germany as the German national gas quality standards demand a lower oxygen level because oxygen damages the underground storage sites located close to the Danish-German border. In fact, different gas quality standards could provide an obstacle to the free movement of gas with injected renewable gas.

Commission Regulation 2015/703 establishing a Network Code on Interoperability and Data Exchange rules provides guidelines on how to address the potential cross-border trade restrictions due to gas quality differences³¹. Article 15(1) provides that

the Transmission System Operators (TSOs) should cooperate to avoid restrictions to cross-border trade due to gas quality differences, and have at their disposal tools such as swapping and co-mingling.

In case the cross-border trade restrictions are unavoidable, Art. 15(2) of the Network Code foresees a series of concrete actions that the TSOs are obliged to undertake within one year. It includes the submission of a joint proposal by the TSOs to the relevant NRAs, preceded by a cost benefit analysis and a public consultation, in order to find the most viable and cost-effective solution. It should be noted that these steps are to a large degree based on the goodwill of the involved TSOs and NRAs.

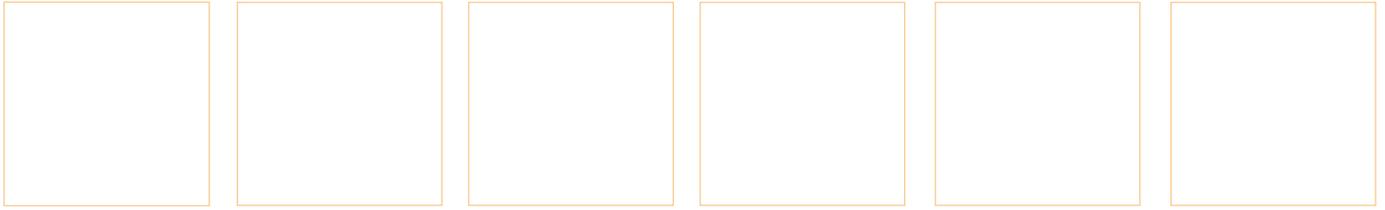
It seems that at this stage the currently binding regulatory provisions are satisfactory to address the potential challenges, provided the actors involved exhibit goodwill. This view is supported by the findings of the 2016 ENTSOG Implementation Monitoring Report that identified a potential trade restriction only on one Interconnection Point (IP). The procedure of Art. 15(2) has never been triggered, as any arising gas quality issues have been solved by the way of mutual cooperation between TSOs³². However, the gas quality in the EU should be monitored regularly, as it is possible that with the increase of the injection of renewable gases into the gas grids this issue will require a more decisive approach in the future.

On the basis of different experiences in different Member States a European benchmark on odorization and control processes could be established. The Directive on common rules for the internal market in natural gas adopted in 2009 encourages the Member States to support the use of renewable gases, pro-

30. First ACER Implementation Monitoring Report of the Network Code on Interoperability and Data Exchange, 4 December 2017, pp. 18-19.

31. Commission Regulation (EU) 2015/703 of 30 April 2015 establishing a network code on interoperability and data exchange rules.

32. Implementation Monitoring Report of the Network Code on Interoperability and Data Exchange Rules, 19 September 2016, p. 22.



vided that their access to the gas grid 'is compatible with the relevant technical rules and safety standards on an ongoing basis'³³. The safety issues should be regarded with the upmost importance and are crucial to encourage the penetration of renewable gas in the existing gas grid.

After the renewable gas is fed into the gas grid, it mingles with natural gas and can no longer be distinguished³⁴. In order to provide the information to the final consumer about the renewable gas content, the Guarantee of Origin certificates are being issued. To enable cross-border trade the certificates will need to be interchangeable and represent the same value. Ultimately, there should be no differences between domestic and imported renewable gas³⁵.

5. Renewable Gas is Currently a Key Decarbonisation Option for the Gas Sector

The gas sector should engage in the EU's decarbonisation efforts in order to remain an important ingredient of the EU energy system in the long-term. We believe that the injection of renewable gas into the existing gas grid is the most politically acceptable and economically viable option, which at the same time, do not require the consumers to change their energy consumption patterns.

The analysis of the European Union's experience with renewable gas production demonstrated that the boost in the green gas production will not be possible without the change of current *status quo*, thereby we propose to:

- Incorporate a soft target for renewable gas injection into the gas network
- Encourage the creation of the incentives for the green gas injection into the grid
- Incentivise innovation through regulatory changes
- Introduce an European benchmark on the odourisation and control processes in order to avoid potential cross-border restrictions in renewable gas trade
- Monitor, on a regular basis, any issues that can constitute a challenge to cross-border trade in renewable gas.

33. Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC, recitals para. 26.

34. Spijker, E., *et al.* (2015). A level playing field for the European biogas and biomethane markets - Case of the Netherlands and Germany: policy environment, key differences and harmonisation issues, pp. 4-5.

35. Biomethane. Status and Factors Affecting Market Development and Trade. A Joint Study by IEA Bioenergy Task 40 and Task 37, September 2014, p. 55.

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