TOWARDS A NET-ZERO CARBON ECONOMY: THERE IS NO FUTURE FOR FOSSIL GAS

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As the Commission is initiating a new reflection about the future of gas, it is worth recalling that the Paris Agreement aims at holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels. In light of the approach of shared but differentiated responsibility, it means that the European Union should reach a net-zero carbon economy as early as possible and in any case before 2050 and increase its 2030 greenhouse gas emission reduction target to at least 55%.

Consequently, **we should fully phase-out fossil fuels by the middle of this century**. Europe should stop using coal and lignite by 2030. They should also phase-out fossil gas as soon as possible in the power sector where renewable energy sources are available, and progressively in other sectors (heating, industry) as alternatives emerge.

For some usage, electrification based on renewable energy sources can replace fossil gas. However, electrification is unlikely to supply all energy needs. Other sources will be necessary, such as heat and renewable gases (hydrogen, biomethane, power-to-gas...). This paper aims at discussing the definition of renewable gases, their role in a net-zero carbon economy and their potential to complement electrification by 2050.

1. Overestimated gas demand and underestimated energy savings: two sides of the same coin

Both the Commission and the gas sector have a history of overestimating gas demand in their scenarios.[1] The European Court of Auditors itself criticised this situation in 2015: "*the Commission has persistently overestimated gas demand during the period, and needs to restore the credibility of the forecasts it uses*".[2] Erroneous forecast made for the pleasure of promoters of projects such as Nord Stream and the Trans-Adriatic Pipeline risk however **to turn billions of euros of investment into stranded assets**. Transmission system operators, often acting also as project promoters, play a crucial role in overestimating gas demand. This is notably visible in ENTSO-G's ten-year network development plan (TYNDP) which aims to provide a consistent view of the pan-European gas infrastructure and signal potential gaps in future investment. In 2009, gas TSOs expected a gas demand increase of 8% in the period 2010 to 2013 while in fact gas consumption decreased by 14%. Although gas demand has since then increased in particular due to severe winters, the trend towards 2050 shows a massive reduction in gas consumption. This misperception goes with underestimating energy efficiency and saving policies. **For every 1% increase in energy efficiency, there is a 2.9% reduction in gas imports**.[3] Adequately factoring in energy efficiency progress has a major impact on fossil gas consumption, especially in the industry and building sectors.

Even with very ambitious energy efficiency policies, it is acknowledged that electrification is not likely to satisfy 100% of the energy consumption. According to the Greens Vision Scenario, electricity would

[1] E3G, *Europe's declining gas demand: trends and facts on European gas consumption*, 2015.
[2] European Court of Auditors, *Improving the Security of energy supply by developing the internal energy market: more efforts needed*, 2015.
[3] Energy Union Choices, *A Perspective on Infrastructure and Energy Security In The Transition*, 2016.

satisfy some 50% of final energy consumption in 2050 while renewable gases would meet 15 to 20%.[4] The renewable industry sector (Wind Europe) argues that a very ambitious electrification policy could lead to electricity representing 62% of energy consumption by 2050.[5] According to Eurelectric, even the most advanced electrification policies would leave electricity to a maximum of 60% of energy consumption by 2050.[6] On the civil society side, Energy Watch puts electricity at a level of 85% of the primary energy demand in 2050, in a 100% renewables scenario.[7]

We can conclude that **there could still be a limited place for renewable gases in the future**, for example in the power sector to balance variable renewable generation and replace coal in some remote and isolated regions. We may also need renewable gases in the industry, in some segments of the transport sector where electrification is not feasible and for individual heating in some urban areas not connected to a district heating system. The limited volumes of renewable gases required for these services will need to comply with the requirements of a net-zero carbon economy.

2. What potential for renewable gas in Europe?

A recent study from the European Climate Foundation outlines three pillars for a fossil-free Europe by 2050: building efficiency, renewable smart electrification and long-term storage, including renewable hydrogen.[8] Indeed, we believe **that energy savings, electrification and other renewable fuels should replace fossil gas**. The remaining share of gas that we cannot substitute with these alternatives should be 100% renewable. However, the cost-effective potential of renewable gas in Europe is assessed at very different levels.

Research conducted in some Member States shows a very large potential for renewable gas used in heating systems and in the transport sector based on a combination of different technologies (biogas, gasification, methanation). For example, France enshrined into law that 10% of the gas consumed in 2030 should be biomethane.[9] The French Environment Agency ADEME released robust scenarios for 100% renewable gas by 2050.[10] Gas TSOs gathered in the European alliance "Green Gas Initiative" put forward similar objectives for Sweden: 30% renewable gas in 2030 and 100% in 2050.[11] The study realised by Ecofys for the industrial consortium "Gas for Climate" sets the potential of renewable gas at a level of 122 bcm by 2050.[12] In a more recent study conducted by Navigant, they expect around 270 bcm of renewable gas by 2050.[13] On its side, Eurogas estimates with a study based on PRIMES that 76% of present-day gas demand could be renewable by 2050.[14] On the other side of the spectrum, the Oxford Institute for Energy identified a potential of only 50 bcm by 2030 for renewable gas, i.e. some 10% of current gas consumption.[15] The ICCT is even more conservative, placing the potential of renewable gas at maximum 36 bcm by 2050, i.e. some 12% of gas demand by 2050 based on Commission's former Reference Scenario.[16] This difference is mainly explained by the use of different costs, yields and technology developments but also a more realistic estimation of the additional electricity available for hydrogen and power-to-gas.

[4] Greens-EFA and Öko Institut, *A Vision Scenario for the Energy Union*, 2018
[5] Wind Europe, *Breaking new ground*, 2018.
[6] Eurelectric, *Decarbonization pathways*, 2018.
[7] Energy Watch, *Energy Transition in Europe Across Power, Heat, Transport and Desalination sectors*, 2018.
[8] European Climate Foundation, *Towards fossil-free energy in 2050*, 2019.
[9] GRTgaz
[10] ADEME, *Un mix de gaz 100% renouvelable en 2050 ?*, 2018.
[11] Green Gas Initiative, Biomethane, *Naturally green gas*, 2017.
[12] Ecofys, *How gas can help to achieve the Paris Agreement target in an affordable way*, 2018.
[13] Navigant, *The optimal role for gas in a net-zero emissions energy system*, 2019.
[14] *Euractiv*, 25 September 2017.
[15] The Oxford Institute for Energy Studies, The future role of gas in decarbonising European energy markets, 2017.
[16] ICCT, *What is the role for renewable methane in European decarbonization?*, 2018.

The question of the renewable gas potential is of major importance in relation to the existing and future gas grid configuration. As outlined by the Council of European Energy Regulators, "*a continuous decline of gas demand could potentially lead to under-utilisation and stranding of network assets.*"[17] The current gas grid may represent a useful instrument to the extent that renewable gas could progressively replace fossil gas flows and supply sectors where electrification is not cost-optimal or not technically feasible. It could be the case for individual heating in some areas. It could also be the case in the power sector through a combination of storage and highly flexible gas-fired power plants, which would run a very limited number of hours to balance the electricity system.

However, **transmission system operators and the gas industry use overly ambitious renewable gas scenarios to justify the prolongation of expensive investment in the gas infrastructure, hereby being nothing more than greenwashing**. The Commission itself considers that the EU gas network will be fully resilient in terms of security of supply as of 2022 when the last "missing links" and "reverse flows" are completed in Central and South-Eastern Europe. Furthermore, the geography of biogas is very different from the supply corridors of fossil gas and the existing infrastructure may turn poorly adapted to the emergence of scattered biomethane injection points.

Subsequently, **there is a high risk that illusionary renewable gas scenarios never materialise and lead to either stranded assets or a high-carbon lock-in**. We should optimise the use of existing infrastructure and consider the argument of renewable gas massively flowing into the system in a very cautious way before it justifies any new infrastructure investment. Additionally, transforming the current gas infrastructure grid to accommodate renewable gas and large quantities of hydrogen would require important and costly upgrades, from the production site to the injection up to industry and household appliances. For example, today, gas turbines can only run with a maximum of 5% hydrogen incorporated in natural gas.[18] A switch may not be as easy and economically viable as it might sound.

Finally, all these assessments focus exclusively on the European Union and do not take into account the potential for imports from third countries. We believe that such imports should be exclusively limited to renewable gas that are produced in a sustainable way, in partnership with local populations and local governments, contrary to "Desertec-style" projects risking to perpetuate the Western appropriation of resources located in developing countries.

3. What is exactly renewable gas? We need a consistent taxonomy

The gas industry often refers to "green gas" without offering solid guarantees about its sustainability and its lifecycle greenhouse gas emission performance. Likewise, a **dubious new terminology emerges** amongst decision-makers, such as "near-zero carbon gas" or "sustainable gas". We need to ensure that renewable gas follows strict sustainability criteria and that adequate terminology is employed to qualify the various gases involved in the discussion.

One way to produce renewable gas is to use agricultural waste and residues as feedstock for biogas and upgrade it into biomethane. This pathway can only be viable at the local level, where waste and residues are available in sufficient quantities. **Biogas production should in no circumstances use imported feedstock or dedicated crops.** It should also not incentivise the development of mega-farms. This solution can however be interesting from a social perspective as it offers new revenues for small farms. The revision of the Common Agricultural Policy is an opportunity to support this transition. Some potential also exists in urban areas. Pursuant to EU law, organic waste collection will

[17] CEER, *Study on the future role of gas from a regulatory perspective*, 2018.
[18] https://powertheeu.eu/

become mandatory as of 31 December 2023. While biomethane obtained this way is renewable, the process should however guarantee the absence of methane leakage to be climate compatible.

The case of hydrogen and power-to-gas is more complex. Hydrogen could become a relevant energy carrier to balance renewable energy sources in the electricity sector, provide with seasonal storage and replace fossil gas in the industry. However, its production by electrolysis or by reforming are very costly and highly inefficient processes. In addition, hydrogen is not renewable in itself. Its renewable nature depends on the sourcing of the electricity used for the electrolysis process. **We should only label 'renewable' the hydrogen produced with renewable electricity.** The industry refers to 'blue hydrogen', 'green hydrogen', 'grey hydrogen' - and maybe soon 'pink hydrogen'?[19] Rather than exhausting all the colours of the rainbow, **we should establish strict and transparent definitions based on sound criteria**.[20] One of the largest pilot project in Europe is the H2FUTURE factory in Linz, led by Voestalpine, where 100% of the electricity used for hydrogen production is renewable (from hydroelectricity).[21] Renewable electricity sourcing for hydrogen production can come from a fully dedicated renewable power generation capacity or from the electricity grid, using renewable electricity that is curtailed and would otherwise be lost. However, we will progressively remove congestion thanks to grid reinforcement, cross-border trade development, flexibility and demand-side management. Thus, **it appears risky to base the future of our energy system on such a weak and unpredictable business model relying on curtailed renewable electricity only**. As outlined by the European Parliament Research Service, "*In the longer term (2030-2050) it is likely that hydrogen production costs will reach the level of today's biogas production costs, but synthetic methane is expected to remain a relatively expensive option. At present, the focus on using hydrogen as a replacement for natural gas in the European gas grid, either by admixture or by 100 % conversion, is currently limited to a small number of countries.*" [22] A necessity for hydrogen development is to achieve cost-reduction. This requires a European industrial policy, notably on electrolysers, a key technology where EU could show leadership,[23] on the model of European Battery Alliance.

In addition, these technologies can also trigger indirect fossil fuel expansion when limited amounts of renewable electricity are available in a given region and redirected to power-to-gas and hydrogen generation rather than supplying other usage.

Similar sustainability issues arise when we refer to synthetic fuels and power-to-liquid, primarily used in the transport sector. Alongside fuels of non-biological origin, the Renewable Energy Directive defines recycled carbon fuels as: "*liquid and gaseous fuels that are produced from liquid or solid waste streams of non-renewable origin which are not suitable for material recovery (...), or from waste processing gas and exhaust gas of non-renewable origin which are produced as an unavoidable and unintentional consequence of the production process in industrial installations*". This definition falls short of ensuring fully sustainable sourcing. The combustion of recycled carbon fuels emits CO2. Hence, **CO2 used in its production should come from direct air capture, a very costly and highly inefficient technology**.[24] Otherwise, synthetic fuels risk encouraging CO2 emissions from the industry sector and simply transfer emissions further down the lifecycle.

[19] Hydrogen industry has been introducing colour-coding for different types hydrogen without disclosing the actual sourcing of electricity used to produced hydrogen.
[20] http://www.certifhy.eu/
[21] http://www.voestalpine.com/group/en/media/press-releases/2018-04-16-H2FUTURE-on-track-construction-starts-at-the-worlds-largest-hydrogen-pilot-facility/
[22] EPRS, *Sector coupling: how can it be enhanced in the EU to foster grid stability and decarbonise?*, 2018.
[23] Energy Brainpool, *Auf dem Weg in die Wettbewerbsfähigkeit: Elektrolysegase Erneuerbaren Ursprungs*, 2018.
[24] Agora Energiewende, *The Future Cost of Electricity-Based Synthetic Fuels*, 2017.

4. The methane problem remains largely unaddressed

Like all burning of fossil fuels, gas releases CO2 in the atmosphere, contributing to climate change. What is more, methane from natural gas, liquefied natural gas or even biomethane, if released to the atmosphere during exploration, transport or conversion (fracking, incomplete flaring...) is an even more powerful greenhouse gas. **Data is however not robust enough** and the EU should engage in a large-scale exercise of data collection on methane leakage. As an example, research from the Environmental Defence Fund shows that estimated methane emissions from the oil and gas sector were 60% lower than actual emissions.[25]

The IPCC estimates that methane is 34 times more potent than CO2 in terms of greenhouse gas impact over a 100-year period. In view of the short life of methane, it means its impact is 80 times that of CO2 when applying a 20-year timeframe[26]. **The methane issue is another reason why we should drastically reduce the place of gas in our economy**. Methane is nevertheless not only a fossil gas issue. Except hydrogen, all types of gases, including biomethane, may emit significant volumes of methane in the atmosphere over their entire lifecycle. For that reason, the Commission should develop a strategic plan for methane, as provided for in Article 16 of the Governance Regulation.

5. Which institutional setting for the development of renewable gas?

Operators of gas networks both at transmission and distribution level are very active in the promotion of renewable gas. This development is certainly positive. It is however not without concern that we observe these regulated entities actively mobilising in favour of a specific technology. We must **raise the question of the limits of the role of regulated entities** in the deployment of new technologies.

The regulatory framework should be updated to avoid undue interaction between the regulated and the competitive segments of network operators' activities. As put forward by the Council of European Energy Regulators, "*one way to address this issue is to apply an approach similar to the one recently suggested in the Clean Energy Package for electricity*".[27] This approach would **condition network operators' ownership, development, management and operation of renewable gas fuelling infrastructure, power-to-gas assets or other new technologies to the absence of market interest tested under regulatory supervision.** The Commission should reconsider the roles and obligations of network operators individually and of ENTSO-G.

[25] Environmental Defense Fund, 2018.
[26] Friends of the Earth Europe, *Natural gas and climate change*, 2017.
[27] CEER, *Study on the future role of gas from a regulatory perspective*, 2018.

Conclusion and policy recommendations

In a net-zero carbon economy, our energy system should primarily rely on energy efficiency measures combined with direct renewable electrification wherever cost-effective and technically feasible. Other renewable fuels may cover the residual fraction of the energy consumption in replacement of fossil gas. In the absence of long-term certainty on their technological maturity and their cost-effective potential, we must be cautious when developing policy incentive to encourage their development, at least until a convincing taxonomy and solid sustainability criteria are established.

We invite the Commission to prioritise the decarbonisation of the economy in line with the Paris Agreement and broader sustainability questions in their reflection related to the future of gas. The upcoming "gas package" should address these elements and bring forward integrated solutions rather than being limited to a light-touch reform of current gas market rules.

We call on the Commission, Member States and other stakeholders to take into consideration the following elements:

1. *Commission and Member States should acknowledge that natural gas of fossil origin has no future in the energy sector and its usage should not be promoted further.*

2. *Commission needs to revise gas demand projection to fully reflect energy efficiency policies, electrification, decarbonisation of the electricity sector and sector coupling.*

3. *Commission, Member States and the industry should stop using the terms "green gas" or "decarbonised gas" or "near-zero carbon gas". The different forms of renewable gases have different efficiencies and lifecycle impacts. They need to be classified and measured and support should be limited to renewable, efficient and sustainable forms of gas. This discussion should take place in the framework of the Renewable Energy Directive. We need a neutral assessment of the potential of such gases with a 2030 and a 2050 perspective.*

4. *Commission, Member States and network operators should not use security of supply as an excuse to expand the gas network further. We should stop investing in more gas infrastructure under the pretext that renewable gas will be massively deployed on the short- and medium-term.*

5. *With the exception of hydrogen, all types of gases imply methane emissions to various degrees due to the inherent nature of the combustion process and the leakage over the production, transmission and distribution systems. Commission should gather more solid data on methane emissions and come forward with a strategic plan for methane.*

6. *Commission should establish the right institutional setting to avoid conflicts of interest where industry both determines the future of gas demand and develops infrastructure projects. System operators should only be involved in ownership or operation of new technologies in the gas sector under regulatory supervision, where market fails to deliver.*