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RePowerEU: Can Renewable Gas help reduce Russian gas imports by 2030?

OXFORD ENERGY COMMENT

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Introduction

On 8 March 2022, the European Commission published its communication "Joint European Action for more affordable, secure and sustainable energy", referred to as "REPowerEU".[1] The communication was in reaction to the Russian invasion of Ukraine in February 2022, and had the objective to "make Europe independent from Russian fossil fuels well before 2030". OIES Energy Insight 110, published in March 2022, focused on a numerical analysis of the short-term objective to reduce imports of Russian gas by two-thirds by the end of 2022.[2] On 18 May the European Commission released a further package of documents, putting more detail around the aspirational targets set in the 8 March publication.[3] Based on both the earlier communication and the further details released on May 18, this Comment considers a longer-term perspective focussing on biomethane and hydrogen, assessing the objectives to increase significantly the production of renewable gas by 2030.

RePowerEU proposals for renewable gas

The following table (extracted from a similar table in the REPowerEU communication), sets out the revised ambition compared to the previous "Fit for 55" target as published in July 2021.[4]

	Fit for 55 ambition	RePowerEU Proposal	Natural gas reduction by end 2022 (bcm)	Additional natural gas reduction compared to Fit for 55 by end 2030 (bcm)
Biomethane	17 bcm by 2030	35 bcm by 2030	3.5	18
Renewable Hydrogen	5.6 million tonnes, saving 9-18.5 bcm	EU production and imports to 20 million tonnes by 2030	-	25-50

While the March 8 document set out clearly the ambition, it did not set out a pathway by which it could be achieved. Since the communication was published within three weeks of the Russian invasion of Ukraine, that lack of detail is perhaps not surprising, and in its conclusion, the communication states that, "The Commission is ready to develop a REPowerEU plan, in cooperation with Member States, by the summer, to support the diversification of energy supplies, accelerate the transition to renewable energy and improve energy efficiency." The May 18 document is entitled "REPowerEU Plan", so presumably is the document intended in March to be released "by the Summer". As will be discussed, however, while it does contain more detail, it still does not detail a clear actionable plan by which the ambition could be achieved, and indeed appears to rely to a significant extent on policies to be put in place by individual Member States to incentivise the required investments.

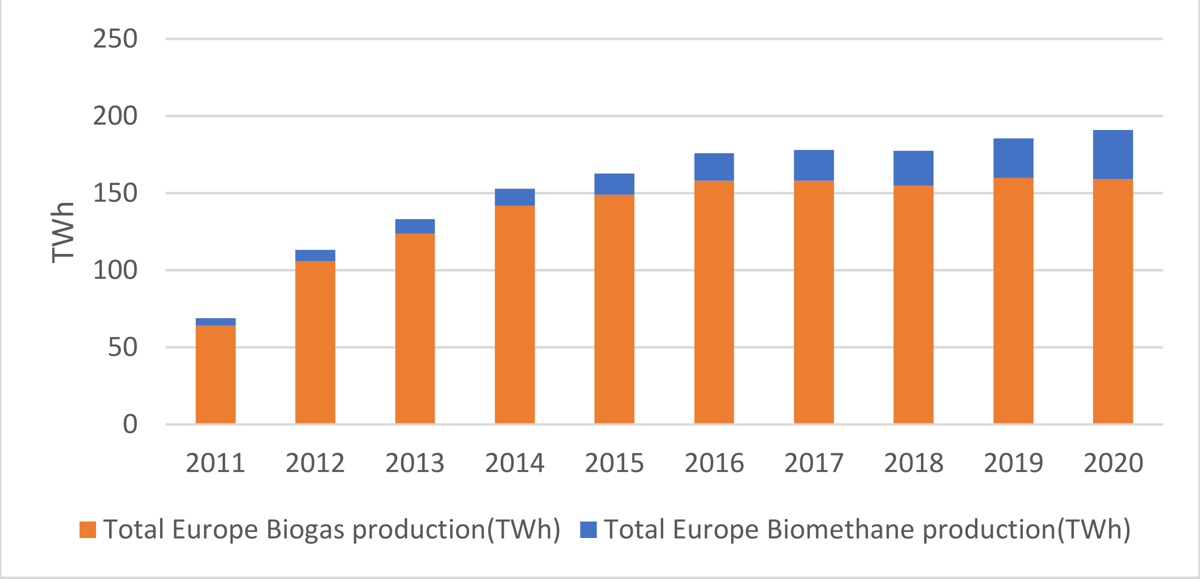
This short Comment considers the extent to which the proposals regarding renewable gases could be achievable and the measures which might increase the chance of them being realised.

[1] European Commission: RePowerEU (March 2022) https://ec.europa.eu/commission/presscorner/detail/en/ip_22_1511
[2] https://www.oxfordenergy.org/publications/the-eu-plan-to-reduce-russian-gas-imports-by-two-thirds-by-the-end-of-2022-practical-realities-and-implications/
[3] https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131
[4] European Commission: Fit for 55 (July 2021): https://ec.europa.eu/commission/presscorner/detail/en/IP_21_3541

Biomethane

In 2020, total biomethane production in Europe was around 32 TWh (3 bcm natural gas equivalent) having grown from around 5 TWh in 2011.[5] This represents a compound annual growth rate of around 23 per cent. Total raw biogas production in 2020, most of which used locally near the point of production for combined heat and power generation, totalled around 190 TWh, so only about 17 per cent of total biogas production is upgraded to biomethane (i.e. a quality suitable for comingling with natural gas in the gas grid). As can be seen from Figure 1, total biogas production grew rapidly (also at a compound annual growth rate of around 23 per cent) between 2011 and 2015, but growth then slowed dramatically. The rapid growth was primarily driven by a favourable incentive scheme in Germany, which was then revised to become considerably less attractive to investors in 2015.[6]

Figure 1: Total biogas and biomethane production in Europe 2011–2020



Source: data from European Biogas Association

These historical observations make it reasonable to conclude that with the appropriate financial incentives, it is possible for both biogas and biomethane to grow at a compound annual growth rate in the range of 20-25 per cent. If current biogas production were to grow at this rate, it could reach around 1000 TWh (100 bcm natural gas equivalent) by 2030. This theoretical growth potential of raw biogas must, however, be tempered by consideration of availability of sustainable feedstock which will impose an upper limit on total biogas / biomethane production. Various studies estimate that the sustainable level of production in Europe could range from around 370 TWh in 2030 to 660 TWh by 2050 (35 - 65 bcm equivalent).[7] For biomethane, the constraint is less around sustainable feedstock, but more around the rate of increase of capacity to upgrade raw biogas to biomethane. If biomethane were to continue its recent rate of growth of around 20-25 per cent pa, total biomethane production could grow to around 200 TWh (20 bcm natural gas equivalent) by 2030. More rapid growth would require some scaling-up of manufacturing and the installation of upgrading equipment, but since this equipment is not particularly complex, a modest increase in manufacturing and installation capacity appears reasonable. For biomethane production to reach 350 TWh (35 bcm equivalent) by 2030 would require

[5] Data from European Biogas Association.
[6] For a more complete description of the evolution of biogas in Europe see Lambert (2017): https://www.oxfordenergy.org/publications/biogas-significant-contribution-decarbonising-gas-markets/
[7] See Gas for Climate (Dec 2021): https://gasforclimate2050.eu/wp-content/uploads/2021/12/The_future_role_of_biomethane-December_2021.pdf p 8-10 for a summary of relevant studies.

an annual growth rate a little over 30 per cent: certainly challenging, but with the right policy incentives, not beyond the realms of possibility.

Since September 2021, natural gas prices in Europe have averaged around 30 $/MMBtu, with a minimum of around 20 $/MMBtu and spikes of over 60 $/MMBtu.[8] These price levels contrast favourably with the cost of sustainable biomethane supply, typically in the range of 15-30 $/MMBtu.[9] If investors had sufficient confidence that prices would stay at current levels, there could be a significant wave of new investment in anaerobic digestion facilities to make biogas and associated plants to upgrade biogas to biomethane. Some customers may be willing to enter long-term contracts to buy biomethane at prices in the range of 25-30 $/MMBtu to ensure future price certainty, but more likely rapid investment will require governments to enter into Contracts for Difference (CfDs) to protect private companies from a sudden downward adjustment in market natural gas prices. A typical CfD would guarantee the strike price to the biomethane producer, with the government paying the difference at times when the reference price (market price for natural gas) was lower than the strike price, and the producer paying the difference to government when the reference price was higher. If the EU and Member States wanted to incentivise rapid investment in biomethane production to be fed into the grid, a series of auctions for CfDs based on the market price for natural gas would seem to be a relatively simple way to achieve this. This simplicity would contrast strongly with the current reality of a complex patchwork of policy incentives which vary by country.[10] This patchwork makes it much harder for a potential investor to identify the best market for its product, and can result in a desire to sell biomethane in a different country where incentives are higher. This cross-border trade, however, is far from straightforward, particularly in the absence of a standardised system of green gas certification across Europe.

A further feature of the current biomethane market, probably undesirable in current circumstances, is that incentive schemes often promote the use of biomethane in the transport sector. For example, in Sweden, 83 per cent of biomethane production is used in transport, while the figure is 100 per cent in Italy. By contrast, in Germany only around 9 per cent of biomethane production is used in transport (aggregate data for total use of biomethane in transport in Europe does not appear to be available).[11] The use of biomethane in transport tends to be high value and hence popular, because of historic incentives (in line with Article 25 of the Renewable Energy Directive or the UK's Renewable Transport Fuel Obligation) whereby biomethane is eligible as a renewable transport fuel under the fuel supply obligation. Since natural gas is not widely used as a transport fuel, such biomethane use tends to be incremental to, rather than a substitute for, natural gas use. Since the driver for the intended rapid increase in biomethane production by 2030 is to reduce reliance on imported Russian natural gas, it would seem preferable to reduce incentives for the use of biomethane in transport and promote the use of biomethane more widely as a substitute for natural gas in the grid.

Overall, increasing biomethane production 10-fold (from around 3 bcm to 35 bcm between now and 2030) will be challenging, but with the right incentive structure, there is some chance that it could be achieved.

Renewable Hydrogen Accelerator

While increasing biomethane production in line with the REPowerEU targets is challenging, but potentially feasible, as described above, accelerating production of renewable hydrogen in line with the target will be much more difficult.

[8] See for example: Fulwood (2022): https://www.oxfordenergy.org/publications/russian-gas-to-the-eu-to-sanction-or-not-to-sanction/

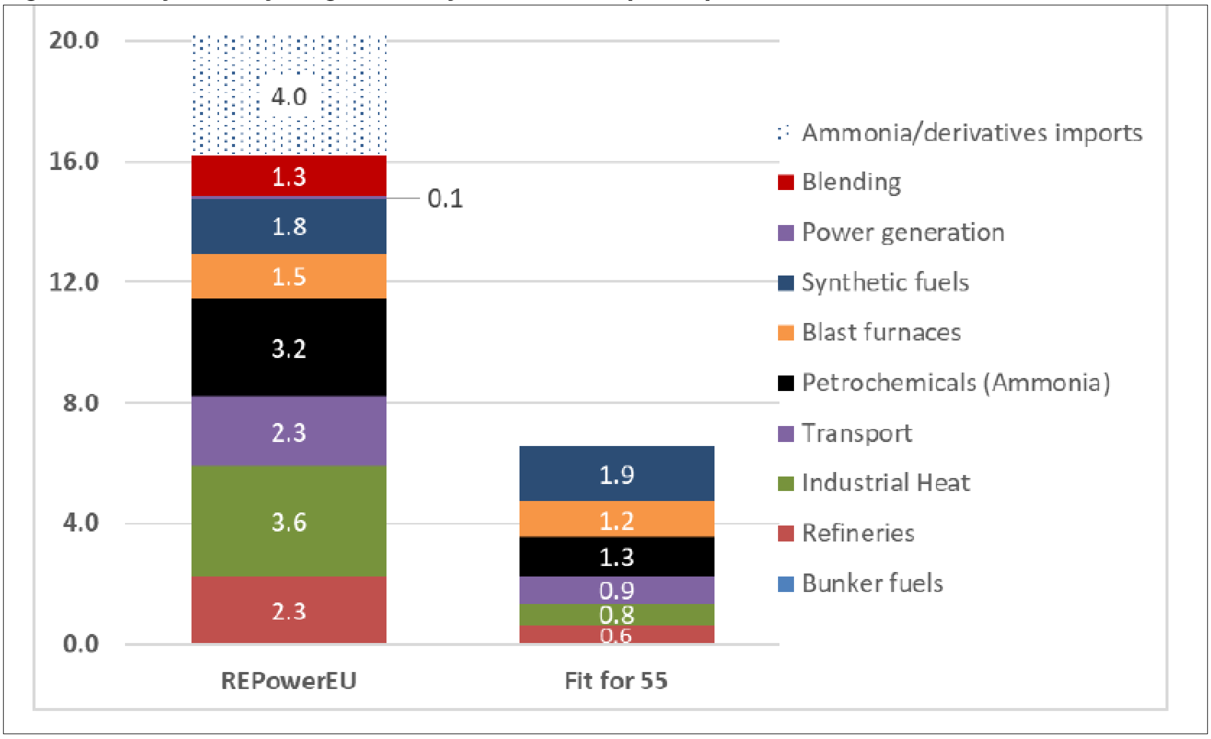
[9] IEA Outlook for biogas and biomethane (March 2020): https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/the-outlook-for-biogas-and-biomethane-to-2040 pages 35-37

[10] See, for example, Gustafsson and Anderberg (2022) for a discussion on the policies in several key European countries. https://www.diva-portal.org/smash/get/diva2:1635090/FULLTEXT01.pdf

[11] Source: European Biogas Association Statistical Report 2021, Table 5.1

The detailed "staff working document" released on 18 May[12] contains further details on the ambition to reach 20 million tonnes of renewable hydrogen by 2030. Figure 2, taken from the staff working document[13] shows its intended use by sector. The potential split across demand sectors is hard to predict but does not seem unreasonable. It appears to contemplate conversion of a large share of the existing use of (high carbon) hydrogen in the refining and petrochemical sectors to low carbon hydrogen, as well as limited introduction of new uses for low carbon hydrogen, such as in steel making, and more industrial heat and transport. The share of hydrogen use for synthetic fuels at around 10 per cent of the total appears, without further explanation, to be rather high, given the relatively immaturity and high cost of the technology. While the demand split appears reasonable, achieving the level of renewable hydrogen production faces significant challenges as discussed below.

Figure 2: Projected hydrogen use by sector 2030 (Mt H2)



Source: European Commission staff working document

The 20 million tonnes per year is intended to be made up of 10 million tonnes of production within the EU and 10 million tonnes of imports. Of these imports, 6 million tonnes is envisaged to be imported by pipeline as hydrogen, and (as indicated in Figure 2) 4 million tonnes in ammonia or other hydrogen derivatives, presumably imported by ship.

It should be noted that current (2021) hydrogen demand (nearly all high carbon hydrogen used mainly in refineries and ammonia production) is around 10 million tonnes, of which around 50 per cent is produced from reforming of natural gas. The REPowerEU Plan envisages a rapid transition away from fossil fuel hydrogen with a target that 75 per cent of industrial hydrogen use in the industrial sector should be renewable hydrogen by 2030. It is not yet clear how this will be implemented. For example, will the EU (and/or Member States) impose a binding obligation on all industrial hydrogen users to switch to renewable hydrogen? Such an obligation would certainly stimulate demand for renewable hydrogen and reduce demand for natural gas, but the cost increase compared with historic hydrogen

[12] EC Staff working document: Implementing the REPowerEU action plan https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52022SC0230&from=EN

[13] Ibid, Figure 4, page 27

production would be very significant. Given that current high natural gas prices have already led to the closure of some industrial gas users in Europe,[14] the resulting increase in industrial production costs would be likely to result in further plant closures in Europe, which may not be desirable from a security of supply perspective.

REPowerEU also envisages increasing the share of "Renewable Fuels of non-biological origin" (RFNBOs, largely understood to be renewable hydrogen and its derivatives) from the previous 2.6 per cent to a new target of 5 per cent. It is interesting that it was felt necessary to increase this target, as fuels displaced in the transport sector are much more likely to be oil products, rather than having a direct impact on requirements for natural gas.

On the supply side, the document suggests that the increase in the renewable hydrogen ambition would require an additional 500 TWh of renewable electricity generation by 2030. In 2020, total EU net electricity generation was 2664 TWh, of which 20 per cent, or 532 TWh, was generated from wind (14.7 per cent) and solar (5.3 per cent).[15] The extra 500 TWh, at 4000 full load hours per year (reasonable for offshore wind) would require 125 GW of additional renewable power and electrolyser capacity. Assuming 2000 full load hours per year (typical for solar power), it would require 250 GW of additional renewable power and electrolyser capacity. Both renewable power capacity increases would also need to be matched by installed electrolyser capacity, although somewhat confusingly the Staff Working Document (in Table 4) suggests that the 2030 installed electrolyser capacity would be 65 (stated as "MW hydrogen", but presumably this was intended to say "GW"), compared to the Fit for 55 target of 44. This figure probably relates to hydrogen output capacity (say, 0.7 times the electrical input) but still appears low in relation to the aspired production of 10 million tonnes renewable hydrogen. It should also be noted that global electrolyser manufacturing capacity in 2020 was estimated at 3 GW pa,[16] so a rapid increase in electrolyser manufacturing capacity (which would also need to serve other growth markets outside the EU, notably in China) will also be required.

Considering that the 2020 level of around 530 TWh of renewable power generation had been achieved by building up capacity gradually over the past twenty years,[17] the aspiration to double this amount by 2030, purely for renewable hydrogen production, does sound rather ambitious. Overall, REPowerEU does contain ambitious targets for both wind and solar power generation, with an intention to reach 510 GW of wind capacity and 592 GW of solar PV capacity by 2030. The EU Solar Energy Strategy[18] published along with the REPowerEU Plan in May 2022 explicitly envisages reaching over 320 GW by 2025 (more than doubling the 2020 installed capacity of 136 GW) and 600 GW by 2030. The plan notes that while 18 GW of solar power had been added in 2020, the plan would require 45 GW per year of new installed solar capacity.

It is interesting to note that globally in 2020, 133 GW of solar power was installed, of which around 45 GW was in China.[19] It is also important to realise that in 2020, around 70 per cent of solar PV module production was in China.[20] Admittedly, the EU Solar Energy Strategy does note, "The marginal EU contribution in the manufacturing and assembly stages of the supply chain, combined with the quasi-monopolistic role of one country at the components stage at a global level, diminishes the EU's resilience in case of extensive external supply disruptions", which is a fairly oblique way of stating the risk that REPowerEU could be interpreted as aiming to switch from over-dependence on Russian gas

[14] For example, CF Industries has announced the closure of one of its ammonia fertiliser plants in the UK https://www.ft.com/content/736739a3-780d-4480-a398-37ce1edf99e8

[15] https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Electricity_production,_consumption_and_market_overview#:~:text=Electricity%20generation-,Total%20net%20electricity%20generation%20in%20the%20EU%20was%202%20664,stood%20at%202%20844%20TWh.

[16] IEA Global Hydrogen Review 2021, p 121

[17] https://www.iea.org/regions/europe

[18] https://eur-lex.europa.eu/resource.html?uri=cellar:516a902d-d7a0-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF

[19] https://www.iea.org/reports/solar-pv

[20] https://www.statista.com/statistics/668749/regional-distribution-of-solar-pv-module-manufacturing/

to over-dependence on Chinese production of solar PV modules. Over time, presumably the EU will aim to increase domestic production of solar modules, but it will likely take several years to overcome the very dominant position of China. These observations serve to underline the importance of considering energy security in the context of the full supply chain of materials to construct infrastructure as well as for fuel supply. In that context, a diversity of supply sources at all points in the supply chain, including infrastructure manufacture, is an important strategy to increase energy security. Once capacity to manufacture renewable power and hydrogen has been installed, the ongoing energy security is considerably better than relying on a dominant supply of fossil fuels from one country, but it will be important to ensure that electrolyser manufacture, and the components required to enable such manufacture, come from a diverse range of supply sources.

Conclusions

This short Comment has made a high-level assessment of the plans in REPowerEU to significantly increase production of both biomethane and hydrogen by 2030. Both the 35 bcm target for biomethane and the 20 million tonnes per annum for renewable hydrogen are certainly challenging and will require rapid implementation of more detailed policy measures. However, given historical rates of growth in both raw biogas production and biomethane upgrading, and given current high gas prices relative to biomethane production costs, the target for biomethane production does seem potentially achievable. It is much more difficult to see how there could possibly be a sufficiently rapid ramp-up in additional renewable power generation and electrolyser capacity in order to achieve the renewable hydrogen targets. It is also not entirely clear that aiming for such a rapid increase in renewable hydrogen would even be strategically desirable as it could be seen as switching an overdependence on Russian gas for an overdependence on the supply of materials from China, given limited other options to source the required PV modules and other materials from a diverse range of countries.

As a historical aside, it is interesting to note that the apparent sudden focus of EU policy on energy security is not new. In November 2000, the European Commission published a Green Paper entitled "Towards a European strategy for the security of energy supply"[21]. As well as calling for a "real change in consumer behaviour" to manage demand, it also stated "As far as oil and gas are concerned, imports of which are increasing, a stronger mechanism ought to be provided to build up strategic stocks and to foresee new import routes". It will be interesting to see whether the REPowerEU initiative will have a greater impact than this paper from more than twenty years ago.

[21] https://op.europa.eu/en/publication-detail/-/publication/0ef8d03f-7c54-41b6-ab89-6b93e61fd37c/language-en