13th March 2024

Future Biomethane Framework

Working group meeting

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Future Biomethane Framework: Call for evidence

This Call for Evidence is `an important step to fully appraise the right policy interventions to incentivise the biomethane industry to scale-up and reach its potential`

- Issued: 29 February 2024
- **Respond by: 25 April 2024**

Government seeking evidence to support the development of the future framework to

- overcome undue barriers for the market,
- increase investment,
- move the industry towards being self-sustaining.

To maximise the potential of the market, the new framework will need to

- facilitate innovation,
- reduce costs,
- accelerate growth in the sector.

Stakeholder workshops for a select cross-section of stakeholders, including trade bodies TBC

Chapter 1

Chapter 1: Design and scope of a new framework

Provides the rationale for continued government intervention to reduce the risk of any hiatus in support.

Looks at the proposed core principles for designing a new policy framework, the technologies in scope and the barriers to investment.

Expect the industry to become financially self-sustaining

The design of the framework is based on five key principles which government will use to guide policy development and set a benchmark for decision making.

Sustainability
Security
Adaptability
Commercial viability
Compatibility

1. a) Do you agree with the principles as a basis on which to develop the policy framework? b) Are there any crucial factors missing?

Chapter 1

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Barriers to an improved investment environment

Key to building the framework will be identifying and overcoming significant barriers to market. Previous interventions focussed on addressing disparity of costs for biomethane production compared to fossil fuel-derived gas.

Further stakeholder engagement has highlighted other key barriers.

- Strategy and messaging need to join-up across government to incentivise investors.
- Uncertainty over demand for biomethane and future of the gas grid
- There is also uncertainty in the supply of sustainable feedstocks.
- Clarity around proper management of digestate (alternative to chemical fertiliser).
- Planning and permitting as barriers.
- Delays and a lack of resilience in the UK supply chain and accompanying skills base.
- Potential revenue streams not utilised across industry (CO_2, digestate, certification schemes, gate fees).
- Grid capacity limitations (injection capacities/Seasonal demand variations/crop cap)
- Propanation Gas networks require to meet the calorific value of biomethane.

2. Are there any other important current or future barriers to market growth not mentioned in Chapter 1 and what actions could the government or industry take to address them? Please provide supporting evidence, including any that highlights the scale of the impact.

3. In your view, what are the most important barriers to market growth that need to be addressed and why? Please provide supporting evidence.

Chapter 1

Framework coverage

RHI and GGSS are GB-wide schemes but relies on specific powers from Energy Act 2008 (does not extend NI). Government working with Devolved Administrations on how framework could apply across the UK.

Production methods under consideration

AD plants for biomethane injection into grid

Combined Heat and Power (CHP) conversions and expansions

Small-scale / on-farm AD

Advanced Gasification Technology (AGTs)

Landfill gas capture and upgrading

Other technologies

Innovation

To inform this, the following assessment criteria have been considered:

- Technical feasibility
- Technical potential
- Greenhouse gas abatement potential
- Sustainability performance
- Commercial viability and cost-effectiveness

4. Are there any production methods that could have significant potential which are not included in Chapter 1?

5. Provide evidence related to the outlined assessment criteria for any of the production technologies listed in Chapter 1 (or for any additional technologies not included).

Chapter 2

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Chapter 2: The role of biomethane in meeting net zero and energy security

Outlines the strategic role of biomethane up to 2050.....

Biomethane can be used flexibly across many different end-uses – heat, power, industry, transport, agriculture, and hydrogen production. Biomethane's optimal end-use will likely change over time but its flexibility as a fuel provides valuable optionality

Feedstock utilisation/ Biomethane production volumes / Carbon capture

6. What are the most important end-uses for biomethane in the transition to net zero by 2050, and what are the implications for the framework? Please provide supporting evidence where possible.

... and the potential of setting a biomethane volume target or ambition.

- **Time horizon:** the ambition could be over the short, medium, or long-term.
- **Scope:** Geographic /Subsidised vs. unsubsidised /Production methods
- **Volume** (Based on feedstock availability, economic and logistical constraints, digestate).

7. What might be the impact on the UK biomethane market if government were to set a form of biomethane volume target? Please provide evidence.

8. What are the benefits and risks associated with the different approaches (to Time Horizon, Scope and Volume) listed under the production targets section?

9. To what extent will the framework described in Chapter 1 help support an industry that can attract investment and produce enough biomethane to meet the strategic aims in Chapter 2?

Chapter 3

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Chapter 3: Accelerating growth of the sector

Revenues and costs from producing biomethane

- AD plants carry significant upfront capex and ongoing opex costs.
- Estimated for a typical 6 MW plant -capex of £17m and £1.6m in opex per annum.
- Opex for an AD plant is partially determined by the type of feedstock , with further incurred costs for planning, permitting and propanation.
- Four potential additional revenues streams, Digestate, Certification, the Renewable Transport Fuel Obligation and carbon capture

10.What is the current and potential scale of revenues from the green gas certification market? To what extent can this revenue enable future biomethane deployment, and how could the future framework support this? Please provide evidence to support your response.

11.What is the current and potential scale of revenues from RTFCs? To what extent can these revenues enable future biomethane deployment, and how could the future framework support this? Please provide evidence to support your response.

- Biomethane upgrading generates a high-purity (>95%) stream of CO_2 by-product
- Opportunity for AD biomethane to become a negative emission process
- Barriers associated with dispersed and small-scale nature of biomethane plants,
- GGR Business Model could provide future support for retrofit and new-build plants, may be a need to avoid future negative outcomes, i.e. double subsidy.

Chapter 3

12.Please provide any evidence on the current or expected costs (capex and opex) and revenues relating to carbon capture on AD plants.

13.What are the most significant barriers to store and transport the CO_2 to sequestration sites? Where possible, please answer with reference for a range of different sizes and types of biomethane plants.

Environment Agency (EA) published regulatory position statement (RPS) in June 2022 setting out conditions for treating, storing and using CO_2 from AD to meet food and beverage or industrial grade standards. Stakeholders stressed traceability of feedstocks is important to determine whether CO_2 meets the food-grade specifications, which may present a barrier

14.What is currently preventing the industry from maximising the revenue from selling CO_2, for example to the food and drinks industries? Do you expect opportunities for revenue from this bio-CO_2 market to change over time? If so, how?

Gate fees driven by demand, relative to supply, in specific geographical markets, and can vary significantly across regions and time. Contract lengths and energy prices can also be a key determinant of fees. Market intelligence suggests long-term contracts have been harder to secure, impacting on investment decisions, expected Defra's Simpler Recycling policy and the GGSS extension will help.

15.How can gate fees play a role in underpinning new biomethane capacity and what barriers must be overcome?

Chapter 3

The case for a future incentive mechanism

Intention to develop a framework that moves the industry towards becoming self-sustaining and taking ultimate responsibility for an enduring market for biomethane. Incumbent on any future incentive mechanism, to leverage market forces that provide better value for money including driving down costs of production, through innovation or scale

Uptake of new production methods may provide a lower-cost pathway to net zero if they can viably produce biomethane on a commercial basis in the future. Expect a future incentive mechanism to move away from tariffs and instead use a market-based mechanism to prepare industry to bear responsibility for long-term growth.

AD

- Analysis tested whether AD plants could potentially be commercially viable without support for differing costs, revenue stream and hurdle rate thresholds (8 – 14%).
- Analysis suggested AD plants could be commercially viable without financial support when gas prices were 'high` and only partially with lower gas prices, when offset by other revenues, such as higher Green Gas Certificate prices.
- Preliminary analysis indicates a combination of costs and revenue factors must be achieved to ensure AD biomethane is commercially viable and self-sustaining, with prices primarily driven by market forces.
- These conditions create uncertainty and indicate that further government action through a framework to replace the GGSS is likely to be needed to meet a potential biomethane volume target or ambition.

Gasification

- BEIS Review and Benchmarking of Advanced Gasification Technologies- levelised cost of methane production significantly higher than natural gas, landfill gas and anaerobic digestion, when either wood or waste feedstocks are used.
- Gasification should be able to access similar revenues to AD plants.
- Whilst gasification does not produce digestate, there is a potential revenue stream from selling by-product metals.
- Overall, gasification is unlikely to be as or more commercially viable without support than AD, especially as it has not yet been deployed at scale in the UK.

Chapter 3

Landfill gas

- Key costs producing biomethane from LfG include biogas treatment and upgrading, transporting biomethane to the grid injection point and grid connection costs, if required.
- Lower potential production scale compared to AD and gasification but evidence that LFG biomethane production could be cheaper (although higher than fossil-based natural gas) Conversely, with a more involved upgrading process than AD, LFG biomethane might only be economically viable for the largest plants with a sufficient gas production curve. The organic component of landfill, and therefore biogas production potential, will also decrease over time.
- The lower cost of producing biomethane relative to other technologies suggests that it could potentially offer greater competition on biomethane production costs.
- Further evidence and analysis are required to understand the relative carbon-cost effectiveness of supporting the upgrade of LfG to biomethane, and the level of support that would be required to enable commercial viability, if any. Also, we need to better understand the additional potential revenue streams from LfG-to-biomethane, such as certificates.

Other production methods

The case for broadening the new framework to include other production methods based on similar analysis would also need to be considered. Given AD is the most established method of biomethane production, we expect that the need for continued support, or in some cases initiating support, is greater for less mature methods.

16.Please provide further evidence on the potential costs and revenues for production methods discussed in Chapter 1, where you have this information available.

Chapter 3

Life cycle assessment (LCA)

- Previous support for biomethane or biogas production was based on energy output, but consideration is needed on how support can be offered on carbon savings.
- Research to create a methodology for conducting an LCA for biomethane production, initially for AD and gasification on how an LCA could optimise carbon savings across the production process and associated supply chain.
- LCAs and carbon savings could form the basis of future incentive mechanism.

The UK Emissions Trading Scheme and biomethane: current interactions

- UK ETS sets limits and uses carbon pricing to help reduce domestic emissions using a cap-and-trade system level of greenhouse gas emissions.
- The UK ETS covers the CO_2 emissions from any combustion of fuels on a site where combustion units have a total rated thermal input exceeding 20 megawatts.
- Operators using solid or gaseous biomass, or bioliquids for non-energy purposes, can apply an emission factor of zero for the fraction of the total fuel or material that is biomass; as a gaseous biomass fuel, this exemption applies to biomethane.
- As most UK biomethane is injected into the gas grid, under UK ETS rules, combustion emissions from gas mix are charged a carbon price equivalent to pure fossil methane.

Chapter 3

The potential case for change

To support the market growth, it's expected some form of biomethane incentive mechanism will be required so need to explore the long-term viability of market-based revenue streams such as UK ETS to incentivise biomethane production.

Evidence is needed into how the UK ETS treats emissions from combustion of biomethane from the gas grid :

1. How the UK ETS accounts for the carbon-intensity and emissions of biomethane within the gas network grid (e.g. by potentially amending emissions factors); or
2. The potential for the UK ETS to enable operators to identify and account for the quantities of biomethane they source via the gas grid (e.g. the EU ETS approach which enables an installation to use biomethane purchase records to reduce their EU ETS allowances).

17.How could biomethane emissions be reliably differentiated from fossil fuel emissions following the combustion of gas extracted from the gas grid (which is a mix of biomethane and fossil-derived methane)?

18.How could the UK ETS account for biomethane in the gas grid to make biomethane production more financially sustainable?

19.How might UK ETS recognition of biomethane in the gas grid affect UK ETS markets?

Chapter 3

Incentive mechanisms

Market-based mechanisms under consideration are:

Contracts for Difference (CfD)

- CfD model for renewable electricity generation incentivised large-scale production, could do similar, but at the expense of smaller-scale production.
- Other CfDs have used ‘auction pots’ to incentivise competition between technologies, which could be considered if framework expands production methods beyond AD.
- CfD-facilitated large-scale production could have a positive impact on investor perception, but clarity is needed to provide a clear long-term strategy,(target/ambition).
- Scheme design for a CfD would also need to consider how it can utilise geographically dispersed feedstocks in line with strategic aims and the sustainability principle. LCA?

Supplier Obligation (SO)

- An obligation level on energy suppliers either by setting a minimum percentage level of supply or by setting a ceiling of ‘carbon intensity’ on the energy that is produced.
- For biomethane, either option could be underpinned by a tradable certification scheme to prove compliance.
- Unlike a CfD, SO would stimulate demand from the energy supplier side of the market.
- SO schemes in other areas have focused on specific end-uses, e.g. RTFO but this would need to have a flexibility of end-use, including future decisions on the gas grid.
- SO might complement a production target, providing a long-term signal for investment SO certificate prices are market-led so there may be less revenue certainty compared to a CfD, though long-term Gas Purchase Agreements could be used to mitigate this. Scheme design would need to ensure intent to use a variety of feedstocks is met, LCA.

Chapter 3

Grants and loans

- Defra grants, such as the Farming Investment Fund, used to help facilitate the decarbonisation and increased sustainability of agriculture, as a standalone mechanism.
- Won't leverage market forces to drive down costs in the same way as an SO or CfD, but could be valuable for targeting hard-to-abate sectors, or neglected/dispersed feedstocks.

Hybrid option

- Could take the form of a 'single pot', applicants submit a business case for a specific decarbonisation project to gain access to funding. Eligibility criteria to be determined.
- Alternatively, a suite of offers to address specific aims across the stated sectors in need of decarbonisation and/or bolster the uptake of a range of technologies.
- May come at the expense of clarity and long-term certainty for the industry.

20.Which mechanisms are most likely to ensure we meet our strategic aims in Chapter 2, and why?

21.Which mechanisms are most likely to comply with all the principles listed in Chapter 1, and why?

22.Which mechanisms are most likely to assist with overcoming the barriers to market growth listed above, and why?

Chapter 4: Sustainability

Chapter 4

Criteria	Relevance
Costs	Ensure the production of biomethane is feasible from a financial standpoint – includes gate fees, transport costs, production costs
Greenhouse Gas (GHG) Emissions	Reducing GHG emissions is at the centre of these policies in order to contribute to achieving net zero – includes upstream, bio generation and downstream
Air Quality Impacts	Important in considering the effects on local residents and biodiversity in line with key Biomass Strategy principles – includes particulate matter, ammonia, nitrogen oxide, sulphur dioxide, methane and non-methane volatile organic compounds (VOC)
Land Use	Opportunity cost of using the land for other purposes such as food production.
Water Quantity Requirement	Should minimise water use where possible.
Water Quality Impacts	Important due to its effects of the local community and biodiversity

23. a) What are your views on the criteria set out in Chapter 4 for assessing feedstocks? b) Are there any additional criteria that we should consider?

Chapter 4

Chapter 4: Sustainability

Chapter 4 highlights the current sustainability landscape of the production of biomethane via AD in the UK. This section also covers why it is critical that biomethane production contributes optimal carbon savings through robust sustainability criteria that minimise environmental impacts and accounts for the latest technologies and policies, such as carbon capture.

- **Food waste:** offers upstream carbon savings diverting waste from landfill, low cost.
- **Cattle and pig slurries:** upstream carbon savings, reducing methane emissions.
- **Sewage sludge:** lacking evidence on upstream carbon savings, AD is preferred
- **Crop feedstocks:** crop feedstocks has benefits but lacks upstream carbon savings

24.With reference to the feedstock sustainability assessment criteria in Chapter 4 (or any other suggested criteria), please provide any data on AD feedstocks that you think we should consider in future policy.

25.With reference to the feedstock sustainability assessment criteria in Chapter 4 (or any other suggested criteria), please provide any data on feedstocks that are specifically used by non-AD biomethane production methods (outlined in C1).

Feedstock considerations

- Feedstock availability: this is the key dependency and a limitation
- Feedstock type and usage: incompatible limitations maximising biogas yields.
- Geographical location: transportation logistics may be challenging
- Wider environmental considerations around energy crops

Policy options

Important to ensure the future framework encourages uptake of sustainable feedstocks

- Adopt a waste feedstock threshold model.
- Adopt a prescriptive approach to feedstocks under a new scheme.
- Encourage the use of sustainable feedstocks through target setting.

26.What are your views on the approaches set out in Chapter 4 for prioritising feedstocks? Are there any alternative approaches that we should consider for future policy?

- Environmental impacts- ammonia release. methane emissions, over-application
- Quality concerns (plastic contamination). BSI PAS 110 standards may be too low.
- Quality Protocol for waste digestate makes it costly to ensure it is fit for purpose.
- Digestate valorisation varied, assumed sales of digestate hold little or negative value

27.What is the current and potential scale of digestate revenue? To what extent can this revenue enable future biomethane deployment, and how could the future framework support this? Please provide evidence to support your response.

Chapter 4

Digestate and ammonia

- Increase in AD partly contributed to an increase in ammonia emissions, (digestate).
- Slurries and manures, recognised as main sources of natural ammonia emissions.
- Beyond environmental issues, as ammonia is lost from digestate its less nutrient-rich.
- Ammonia abatement methods and technologies (e.g. covering stored digestate, ammonia stripping-scrubbing, nitrification-denitrification, acidification, gas-tight covers, and low-emissions spreading techniques) .

28.What are the barriers, if any, preventing UK AD sites and farmers/landowners from implementing additional ammonia abatement methods, such as the ones identified in the 2023 WRAP study for DESNZ?

Digestate and nutrient balancing

- Future biomethane framework will likely lead to the production of more digestate, Important to ensure digestate is applied in right quantities in areas that need nutrients
- Concerns that nutrient loading could lead to adverse impacts on water quality and soil health
- Further work is needed to determine the likely volumes of additional digestate and sustainable pathways for its utilisation or disposal.

29.How do you consider nutrient balancing in relation to your handling and use of digestate? We particularly welcome views from landowners, farmers, and AD operators.

30.What are the practicalities, costs, and potential environmental impacts associated with transporting digestate to areas with a nutrient-deficit? Please provide evidence to support your response.

Chapter 4

Digestate and plastic contamination

Understanding of measures to effectively address this issue is required and seeking views from the industry on preferred methods of removing caddy liners and other food packaging from food waste. Evidence collected here will also inform ongoing evidence gathering within Defra on this issue.

31.Can all AD food waste plant operators accept and process food waste with caddy liners or other food packaging included?

32.If liners and food packaging are included, what material types a) are AD plants able to process? b) are preferred? c) are least preferred and why?

33. If liners and food packaging are included, are they typically: a) not stripped (i.e. left to be treated by the AD process)? b) stripped and sent to a separate composting phase on-site? c) stripped and sent to a separate composting facility (off-site)? d) stripped and sent to incineration? e) stripped and sent to landfill? f) other (please describe)

Methane emissions

- Biomethane from AD directly contributes towards tackling methane emissions waste management technology. Potential risk of fugitive methane emissions from the biomethane production process, particularly from AD should be addressed
- The Environment Agency (EA) has developed and intends to publish a methane action plan, tackling methane emissions across the sectors, including waste feedstock AD.
- Biomethane industry encouraged to engage with the EA to ensure industry and government take the right steps to effectively reduce methane emissions.

34.Please provide any evidence you have on the benefits and costs of detecting, monitoring or repairing methane leakage from AD sites.

35.What challenges might the biomethane industry face if future government policy sets a limit on fugitive methane emissions from biomethane production?

Non-AD biomethane production methods and sustainability

Considering the case for including a variety of non-AD biomethane production methods in the policy framework, including their sustainability performance. Intend to use this Call for Evidence to collect evidence and data on these production methods for inclusion. This could include, carbon emissions, impacts on air, water/ soil quality, and biodiversity.

36.What are the key sustainability considerations for any non-AD biomethane production technologies that could be in scope for the future framework? Please specify which technology your answer relates to.

Chapter 5

Chapter 5: Planning and standards

Planning reforms set out in the Levelling Up and Regeneration Act aim to deliver improvements. One of the key issues raised by stakeholders relating to delays in deployment is challenges in the planning process. As part of this Call for Evidence, we are seeking to understand the reasons for this in more detail, and in particular, if there are any unique barriers AD plants face in the planning system.

37.Have you experienced or are you aware of any challenges with the planning process for AD plant developments? If yes, please provide details.

38.What type of AD-specific information would be useful to local planning authorities when reviewing planning applications for AD plant development?

Some AD plants require an environmental permit to operate, however regulatory standards vary according to the feedstock used and apply only to AD sites processing waste feedstocks. This regulatory gap around non-waste AD could restrict the ability to ensure the same levels of protection, regardless of the feedstock used. This also limits opportunities to maximise the capacity of existing AD infrastructure through co-digestion of waste and non-waste feedstocks.

39.What are the benefits and risks that would need to be considered in changing the permitting regime to apply the same regulatory standards to AD sites processing waste and non-waste feedstocks?

Currently, all UK AD plants must comply with regulations for environmental protection, animal by-products, duty of care, health and safety and waste handling. However, the AD process is often regulated without focus on the overall building or production of biomethane, a lack of overarching plant and equipment standards, and poor visibility to regulators. A Best Available Techniques (BATs) review associated with environmental permitting for preventing or minimising emissions and impacts on the environment could addressed this.

40.What are your views on the feasibility and usefulness of developing industry-wide guidance on design, maintenance and operation standards for AD plants?

Chapter 5

Capacity is often not available at injection rates required by a commercial scale AD plant. Demand is also seasonal and fluctuates throughout the day meaning, plants have to reduce rates temporarily or seasonally. Solutions being investigated include:

- reverse compression,
- increasing connections between parts of the grid to improve pressure
- improving or altering grid flow management and tracking.

41.What is the impact of grid capacity, now and in the future, on the development, operation and output of biomethane plants? Please outline where this differs between distribution and transmission level and between production technologies.

42.Are there any steps the government and the industry could take so that biomethane producers could more easily access reliable grid injection capacity?

43.Which technologies, including reverse compression, could increase grid capacity access for biomethane plants and what are the associated costs and barriers? Please provide evidence for your suggestion, including details on costs where possible.

Solutions are being explored to reduce the use of propane, including methane blending and using modelling to bill customers when a more varied range of CV gases are injected into networks.

44.What steps need to be taken by the biomethane industry, gas networks or the government to reduce or remove the need for propane in preparing biomethane for injection to the gas grid while maintaining fair billing for gas customers?

The 'ideal' location for biomethane production should balance accessibility to feedstocks with proximity to its end-use, while also considering environmental impact. With the focus n grid connection this becomes a **bottom-up, market-led.** A more **top-down, government-led approach would** identify suitable locations based on feedstock, end use, CCUS offtake and more targeted environmental impact.

45.What are you views on the best approach to enable optimal plant locations in the future framework? How might this differ across different production technologies?