Department for Energy Security & Net Zero

Evaluation of the Green Gas Support Scheme and Green Gas Levy

First Annual Interim Report Annexes

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Contents

Annex 1: Evaluation Questions

GGSS Process Evaluation Questions

1. How effective has the implementation and delivery of the scheme been?

    a. What has been the experience of the administration of the scheme (by Ofgem), including payments processes by applicants? Has it created an unnecessary applicant burden or any barriers to further deployment under the scheme?

    b. What problems have applicants faced during the application process?

2. How has the GGSS budget management (budget caps / Annual Tariff Reviews / degressions) affected the schemes attractiveness?

3. How has interaction between the GGSS and other directly linked policies, such as the Renewable Transport Fuel Obligation (RTFO) and proposed Defra Food Waste Collection policies, impacted applications and participants?

GGSS Impact Evaluation Questions

4. Has the scheme achieved its intended impacts?

    a. Including:
    i: increasing deployment of renewable heat;
    ii: reducing GHG emissions through decarbonising homes and businesses;
    iii: delivering expected carbon savings;
    iv: increasing investment in the AD sector in the UK.
    b. To what extent can the achievement of objectives be attributed to the scheme, in comparison to other policies or market factors?

5. What other impacts has the scheme had?

    a. Has the GGSS contributed to the maintenance/ creation of employment opportunities in the AD sector?
    b. To what extent has the scheme impacted areas including air quality?
    c. What has been the typical feedstock mix of a biomethane plants deployed under the scheme?

6. How has the GGSS encouraged the development of a more robust and independent market in the AD sector?

    a. In what ways, and to what extent, has the scheme impacted the longer-term direction and prospects for the AD industry in the UK?

b. Has the GGSS supported the AD industry to be ready for potential future support using a market- based mechanism?
c. What are the implications of findings for future schemes/ delivery or rollout to other settings?

7. How has the design of the scheme (including tariff levels, tiering, degression, ATRs, and eligibility requirements) supported achievement of the scheme objectives?

a. To what extent has the scheme design supported the industry to deploy AD plants?
b. What impact has the GGSS had on AD deployment and efficiency of production?
c. How has the overall subsidy mechanism (15-year, three-tiered tariff) influenced the achievement of the identified impacts?
d. In what ways (through which mechanisms) has the scheme altered (or not) the decision making, activities or investments of stakeholders? What impacts have these changes contributed to?
e. What other factors (e.g. Defra's food waste strategy, RTFO's) have influenced the scale and nature of deployment and how have they interacted with the scheme?
f. In respect of RTFO's, has interaction between the GGSS and RFTO's led to changes in producer flexibility or production levels?
g. Has the scheme encouraged or stifled innovation? What lessons can be learnt from the scheme to support future policy design?

GGL Process Evaluation Questions

9. How effective has the implementation of the GGL been?

a. Are gas suppliers satisfied with the performance of Ofgem administering the GGL, such as in collecting levy payments, chasing non-compliance etc.?
b. Can the Department do anything to support Ofgem to improve its performance?
c. Have the costs/burdens imposed on gas suppliers due to administrative processes been proportionate to the size of the levy/expectations?
d. What opportunities exist for reducing the administrative burden of the levy?

10. Have the administrative processes been sufficient to collect funds in the expected manner?

a. Were the compliance and enforcement measures effective in mitigating against non-compliance and in addressing non-compliance when it arose?
b. Were the administration timings suitable, giving gas suppliers enough time to pay levy, lodge credit cover, pay mutualisation costs, pay penalties?

GGL Impact Evaluation Questions

11. What have the impacts of the levy been, and how did they fit with the Department's expectations?

a. Did the GGL cover the costs of the GGSS?
b. Is it compatible with existing industry processes?
c. Have the financial management systems been implemented within the GGSS implementation time scales?
d. Were there instances of gas supplier non-compliance? Was this deliberate or accidental?

12. What burden has the levy imposed on gas suppliers?

a. Did the levy lead to high time and cost burden for Ofgem to administer the levy?
b. Were the administrative costs for gas suppliers as expected? Were there any unforeseen costs?

13. How has the design of the levy supported the achievement of the GGL objectives?

a. How has the overall levy design, including the meter point design, budget and financial management, and enforcement & compliance, influenced the achievement of the objectives?
b. What challenges to meeting the objectives arose during the length of the levy, affecting its success and effectiveness?

Annex 2: Evaluation Methodology

This Annex outlines our approach and activities undertaken as part of the first year of the evaluation, including: a description of our analytical framework; details of our approach to data collection, analysis, and synthesis; and a note on the limitations of our findings.

Evaluation Approach

Given the methodological challenges in apportioning impact between policy and wider factors by exclusively counterfactual means in this complex setting, the approach that the evaluation of the GGSS and GGL has adopted is theory-based using a contribution analysis structured around two linked theories of change (for the GGSS and GGL) and will be supplemented in later stages (depending on feasibility of sample sizes) with quasi-experimental analysis.

In the scoping stage of this evaluation, the ex-ante theory of change (ToC) for the GGSS was refined, while a ToC for the GGL was developed 'bottom up'. These were completed following a detailed document review, scoping interviews with the relevant department policy team, and a theory-building workshop event. The final ToC diagrams, alongside descriptions of the assumptions and risks associated with each, are included in Annex 3.

Moreover, following an in-depth review of scheme documentation, GGSS and GGL process maps were produced, which provide a 'zoomed in' look at how the scheme and levy are intended to operate, providing an additional framework through which processes have been assessed. The GGSS process map covers all application stages, payment, and reporting. The GGL process map focuses on credit cover, payment, compliance, and exemption. Both maps are presented in 'journey' (flow chart) format in Annex 4.

The ToCs were then used to develop a set of 'contribution claims' each for the GGSS and GGL, which provide causal hypotheses of how the schemes are expected to deliver their intended outcomes, alongside alternative hypotheses for how outcomes could occur due to wide factors (separate from the programme). To conduct contribution analysis, the Theory of Change, existing evidence, and a theory-building workshop have been used to develop causal and alternative hypotheses. Using evidence gathered as part of the evaluation, the plausibility of each hypothesis, or contribution claim (CC), is assessed to determine if outcomes are best explained by that hypothesis, the evidence available is weak or needs to be supplemented, or if alternative explanations of the outcome better explain causality. Alternative hypotheses are a critical part of contribution analysis. Where outcomes are found to have occurred, evaluators can weigh up the influence of the programme versus wider factors in leading to these outcomes, to assess which best explain the outcomes, to come to a judgement on the programme's contribution.

At present, given the focus of the evaluation has been on process, rather than impacts, our methodology has focused less on contribution analysis and quasi-experimental methods, and

more on testing the validity of the two theories of change through evidence gathered in interviews and surveys, and from available scheme data. This has included assessing the evaluation team's assumptions of causal pathways in the theory of change, based on how the scheme and levy have worked in practice, and the factors that have enabled or constrained the realisation of outcomes.

Data Collection and Analysis

Rapid Evidence Review

As part of the desk-based evaluation research, the evaluation team conducted a rapid review of available evidence from policy, academic and industry literature sources, and existing evaluation evidence from other schemes. The review focused on the market, technical, regulatory, and policy context of the GGSS and GGL, scheme and levy processes, and stakeholders. Sources were identified via online searches with questions formulated around the above topics. We then appraised the quality of any identified sources,' drawing on the evaluation team's expertise. Where necessary, quantitative data was also sense-checked against other sources to assess whether the identified studies was within the range of any other estimates available. Ricardo also used its particular experience in the bioenergy sector to identify any areas of weakness in the initial evidence reviewed and any further sources of information to address these. The purpose of the review was to provide insight on why the GGSS was created, how it fits into the UK decarbonisation roadmap, and how the GGSS evolved from the Renewable Heat Incentive. The review is presented in Annex 8.

Stakeholder Interviews

As part of evaluation activities to date, semi-structured interviews have been conducted with 31 stakeholders, summarised in Table 7. The evaluation identified relevant stakeholder populations for interview recruitment and sampled on a stratified or purposive basis, or a census-approach was taken (where sample sizes were small) as described below:

- GGSS applicants included all those who had made an application to the GGSS, either successfully registering their scheme, currently in the process of applying (i.e. having achieved provisional or full tariff guarantee and progressing the next stage of their application) and those whose applications had been rejected. Given low population sizes, we reached out to all those who had applied to the GGSS, in order to fill interview quotas.
- Two distinct groups of GGSS non-applicants were identified: those who represented organisations that had expressed interest in applying to the GGSS but were no longer interested, who were identified based on industry intelligence from the Department, and those who applied for the ND RHI scheme after the announcement of the GGSS in April 2020. For the first of these groups, the evaluation team was provided with contact details for 8 organisations and reached out to them all, given the small sample size. For the second of these groups, 6 organisations were identified and, again, given the small sample size, all were contacted for interview.

- Ofgem stakeholders involved in either the GGSS or GGL were sampled purposively to ensure those with the most relevant knowledge and insights were interviewed.
- Department for Energy Security and Net Zero stakeholders were interviewed as part of evaluation scoping and again in the evaluation research stage. As above, participants were sampled purposively to ensure those with the most relevant knowledge and insights were interviewed.
- Gas suppliers were sampled on a stratified basis to ensure our sample had a suitable cross-section of large and small suppliers (e.g. to consider differences in bearing administrative costs), as well as cross-market and non-domestic suppliers (e.g. to see if any differences in views emerged on issues, such as volumetric levy measurement). An initial sample of 25 was identified, and following challenges in recruitment, an additional sample of 10 were added to boost responses.

Interviewees were invited via email to an online interview via Microsoft Teams, lasting between forty-five minutes and an hour, depending on respondent type. Interviews were based on segmented topic guides and followed a semi-structured approach. Topic guide questions focused on evidence required to answer evaluation questions and are included in annex 4. Interviews were recorded using Microsoft Teams, where consent was obtained for recording.

Participants for interviews on the Green Gas Support Scheme were recruited between February and April 2023. In total we recruited five GGSS applicant respondents and five non-applicants (GGSS Non-applicants and ND RHI Biomethane Plants) to participate in qualitative interviews, against a total target of twelve interviews across these groups.

Participants for interviews on the Green Gas Levy were recruited between June and August 2023. The evaluation achieved its target sample for both the Department and Ofgem but did not reach the target sample size for gas suppliers. The evaluation team made an effort to achieve the target sample of gas suppliers, including resampling and reaching out to a new tranche of gas suppliers following non-response or declined invitations to participate. Of the eight suppliers that did engage in the evaluation, they represented a cross section of large (6) and small[1] (2) suppliers and both cross-market (5) and non-domestic (3) suppliers.

[1] The research team found that small companies were more likely to decline to be interviewed as the levy represented such a minimal cost to their organisation, that they did not feel it was worthwhile to offer their views on it..

Table 7: **Stakeholder Interviews Conducted**

Stakeholder Group	Population Size	Target Sample Size	Achieved Sample Size
GGSS Applicants (registered plants, ongoing applications, unsuccessful applicants)	12	4	5
GGSS Non-Applicants	8	4	3
ND RHI Biomethane Plants (who applied to the ND RHI scheme after the announcement of the GGSS)[2]	6	4	2
Ofgem	N/A	5	5
Department for Energy Security and Net Zero (inclusive of evaluation scoping interviews)	N/A	8	8
GGL Registered Gas Suppliers	~90	20	8
Total	**N/A**	**45**	**31**

For all stakeholder interviews conducted, the evaluation team produced cleaned and anonymised interview transcripts, for case level and thematic analysis. This was conducted using NVivo, a Computer Assisted Qualitative Data Analysis Software (CAQDAS) package. Anonymised Interview transcripts were added to NVivo and were reviewed initially for internal consistency. Transcripts were then coded against an initial coding framework based on the evaluation questions, with coding also occurring inductively, driven by emerging findings. An Initial set of codes were combined to develop themes which respond to the evaluation questions and objectives. Themes were presented alongside an explanation and supporting quotes. Thematic analysis outputs are presented in Annex 5.

Application and Monitoring Data

The evaluation has identified and drawn on four sources of application and monitoring data for both the scheme and the levy. Available GGSS application data was extracted in July 2023 and was cleaned to enable data analysis of key metrics.

For the GGL, performance indicators (e.g. number of gas suppliers, instances of non-compliance, levy collected) from data provided by Ofgem on the Green Gas Levy, including, data from the 2022/23 annual report, as well as other data sets provided by the Department of Energy Security and Net Zero, were used to present a summary picture of levy performance to

[2] These plants have been included because, at the time they applied to the ND RHI scheme, the GGSS had already been announced, and therefore, it is of interest in the evaluation to understand their rationale for applying to the RHI scheme rather than waiting for the GGSS. Late stage RHI applicants are taken to be those who applied to the RHI after 28 April 2020, i.e. after the launch of the Future Support for Low Carbon Heat Consultation, in which the GGSS was announced.

complement qualitative findings. Data tables were compiled, drawing on existing data tables from the report (e.g. on the number of levy payers, amount of levy collected) and using new analysis (e.g. proportion of levy dispersed on the GGSS) and summary text included around the tables, to provide indicative interpretation.

The data sources used are listed below. In some cases, these are publicly available and in others they were provided by the Department for Energy Security and Net Zero to the evaluation team for the purposes of evaluation. They are as follows.

- GGSS Application summary data, extracted in July 2023 and provided by the Department for Energy Security and Net Zero.
- GGSS Annual Report dataset, published July 2023 and available online via Ofgem's website.
- GGSS Quarterly Reports, published quarterly and available online via Ofgem's website.
- GGL Default Register, published August 2023 and available online via Ofgem's website.
- ND RHI Scheme Year 12 Annual Report Dataset, and a bespoke ND RHI data request, provided by the Department.

Analysis of these datasets focused on key scheme benefit areas and metrics that would provide specific insights to answer evaluation questions. Relevant variables were identified from the available datasets, and application data was cleaned and collated to produce a dataset for further analysis. Descriptive statistical analysis was applied alongside data visualisation. In some cases, to unpack data further, additional calculations were completed. The quantitative analysis for the GGSS evaluation involved translating application data for the volume of biomethane (total plant, and volume eligible on the scheme) in M^3 to the level of output in GWh using an online convertor (using a Gross Calorific Vale of 35.17 MJ/m^3). This converted the gas in M^3 to MJ by multiplying the volume in M^3 by the Gross Calorific Value, and then dividing by the conversation factor of 3.6 to convert to KWh. By applying production factors[3], this enabled assessment of the total expected eligible biomethane per year to be injected by applicant plants. The evaluation also used application and decision date data from the application data received to estimate the duration in weeks to progress applications.

For the purposes of comparison, some data from the ND RHI was also included as part of the analysis to show a side-by-side comparison and benchmark figures to aid contextualisation. Analytical outputs were compiled thematically, and summary text was used to draw out findings from data analysis.

Annual Pulse Survey

The purpose of the pulse survey is to provide longitudinal data on Green Gas Support Scheme (GGSS) participants and applicants alongside participants to the ND RHI as contextual

[3] BEIS (2022). GGSS budget caps, production factors, and inflation forecasts for 2023-2024. Table 2: https://www.gov.uk/government/publications/green-gas-support-scheme-budget-management/ggss-budget-caps-production-factors-and-inflation-forecasts-for-2023-2024

evidence on the biomethane sector for the evaluation. Some data from the pulse survey will also be used to answer impact evaluation questions.

With these aims in mind, the pulse survey seeks to obtain data on:

- Employment – numbers, skills and wage costs
- Feedstock – volume, type and geographic origin
- Plant capacity
- Digestate production – volume, storage and management and the proportion replacing traditional fertilisers
- Costs and expenditure – operating costs, gate fees, leveraged finance and GGSS administration costs
- Revenues
- RTFO and RGGO certification
- Carbon capture
- Methane leakage monitoring
- Ammonia emissions mitigation
- Views on other HMG policies affecting the plant.

The current survey sought to capture costs and operational data for the financial year 2022/23. The survey will be repeated in 2025, revisiting the population from the 2023 survey, along with additional AD plants that have registered for the GGSS.

Although survey recruitment took a mixed mode approach (both telephone and email), the survey itself was online. It was formatted similar to a form (i.e. with multiple questions on a page). Accompanying guidance was provided (available when the respondent clicked on a 'further information' button) about the scope of what should be considered (e.g. which costs should be included or excluded).

For the purposes of engagement with the sector / survey recruitment, the pulse survey was positioned as an 'Annual Sector Survey', with the purpose of gathering necessary contextual data for the monitoring and evaluation of the GGSS, to better understand how AD plants grow, interact with other policies and key regulations, and collect wider data of interest such as feedstock mixes.

The population consisted of 26 AD plants. These comprised 15 GGSS applicants (successful or other; details were provided by Ofgem) and 11 organisations / plants who are accessing the ND RHI for biomethane production (provided by the Department). The ND RHI sample included only those from the post-policy reform period given the alignment of the GGSS and post-reform ND RHI policy.

Given the relatively small size of the populations of interest, the evaluation team approached all plants with the aim of surveying as many as were willing to contribute to the work.

Site (i.e. individual AD plant, rather than organisations who may have multiple plants) was selected as the sampling unit (in acknowledgement that site level performance and costs was of most interest to the evaluation). Recruitment to undertake the survey was therefore at site level. Six sites in the population were operated by two organisations. In these instances, individuals at an organisation level were approached to determine the best method/ contact to obtain data at site level.

Attempts were made to reach the contacts by email and telephone. The purpose of using both modes was to explain the purpose of the pulse survey, check the contact was the most appropriate person to respond to the survey, to address any queries or reservations they had and to understand the likely timescale for survey completion.

The approach was piloted with a small number of the contacts during week commencing 7th August 2023, and fully launched on 14th August 2023. Noting that fieldwork coincided with the summer holiday period, it continued until 22nd September 2023, to ensure contacts were given a sufficient amount of time to respond.

The first question in the survey asked respondents to self-select their current engagement with the GGSS, broken down by; scheme participant, scheme applicant or ND RHI participant. The evaluation team were conscious that since receiving the data shared by Ofgem, GGSS applicants may have changed status (e.g. may have been awaiting full tariff guarantee, which was then awarded) and therefore, did not want to presume respondent type.

Table 8: Annual Survey Respondents

Respondent type	Number of contacts in the database	Number of survey responses
GGSS applicants (includes successful applicants)	15	9 (2 complete, 5 nil returns, 2 partial)
ND RHI recipient (Post policy reform)	11	4[4] (2 complete, 1 nil return, 1 partial)
Total	**26**	**13**

In total, 13 responses were received. These comprise:

- 4 complete or near complete responses. These respondents provided an answer to at least the majority of the questions in the survey.
- 6 nil responses. These respondents told us that their plant was not operational in the financial year 2022/23 and therefore their answer to many of the questions in the survey about operations, volumes and costs was ’0’. Some of these respondents provided

[4] One contact that was categorised as a GGSS applicant in the database responded as an RHI recipient.

responses to some questions in the survey where relevant and appropriate to the operational status of the plant.

- 3 partial responses. These respondents provided an answer to some of the questions in the survey, but in particular were unwilling to provide commercially sensitive data.

Challenges and Limitations

The evaluation encountered a number of challenges in delivering against the evaluation plan, which have led to limitations in this evaluation report's findings. Interview research with scheme and levy stakeholders faced the following challenges:

- This research has been conducted at a relatively early stage in the lifetime of the GGSS, with only one fully registered participant plant (which at the time of interview had only completed one submission). This has meant that for findings relating to post-administration scheme processes, findings are limited, given the analytical challenge of drawing conclusions from such a small sample and the disclosive nature of discussing responses from one respondent.
- For interviews with GGSS applicants, there was a relatively small population of GGSS applicants and participants, given the low deployment rates onto the scheme. There were also instances where the same lead applicant organisation represented multiple GGSS applications. In practice, this has meant there have been less opportunities to resample and reach out where invitations were declined. As such, findings in the report are reflective of a small sample size.
- Recruitment of gas suppliers proved challenging, and measures to boost sample sizes were only partially effective. As such, the research was conducted with a small sample of gas suppliers and the qualitative analysis is based on a limited number of perspectives.

A number of challenges were also identified during the annual pulse survey fieldwork, some of which were anticipated at the outset. These included:

- Some respondents were reluctant to provide commercially sensitive data. Whilst assurances were made in the recruitment email and during recruitment calls on how the data was being gathered, stored, and used, some respondents were still unwilling to share this data. As such some responses received have data gaps with regards to employment, feedstock, plant capacity, digestate production, costs and expenditure and revenues.
- One respondent explained that their GGSS applicant AD plant was an extension of an existing facility and as such they were unable to disaggregate the values between the main plant and the extension, meaning data specific to the GGSS-supported part of the plant could not be identified separately.

- Some of the GGSS respondents have effectively provided ‘nil returns’ as plants were not yet operational, therefore, they provided ‘0’ to most of the questions. This provides a baseline, but not necessarily a set of data for analysis at this stage.
- For a handful of GGSS respondents, it has proven very difficult to identify how sites are being managed, and therefore the most appropriate person to respond to the survey. The contact details shared by Ofgem appeared to be for investors with multiple portfolios, such that is difficult to identify which company should be contacted. There is also no digital footprint for some sites, perhaps as they are not yet operational, to identify alternative contact details. This has meant that accessing the relevant individual with the required information for the survey has been difficult in some cases.

Annex 3: Theory of Change

This Annex outlines the rationale for using theories of change in policy evaluation and presents the Green Gas Support Scheme and Green Gas Levy ToCs developed in this study, as well as the assumptions and risks associated with each stage outlined in the respective ToCs.

A Theory of Change (ToC) is a tool to cohesively understand the complexities of a policy by setting out the steps through which it is expected to lead to its desired outcomes. Its aim is to explain how a certain intervention leads to a chain of results that are intended or are observed. It is produced through the synthesis of any existing evidence of causal pathways. A ToC is an important tool in policy evaluation as it provides an opportunity to develop core evaluation questions, to identify key indicators for monitoring and identifying gaps in available data, and to provide a structure for data analysis and reporting.

GGSS Theory of Change

In the scoping stage of the evaluation, the ex-ante ToC for the GGSS was refined following a detailed document review, scoping interviews with the relevant department policy team, and a theory-building workshop event. The ToC diagram developed for the evaluation is presented in Figure 5, and the associated assumptions and risks are listed on the subsequent pages. Below is a narrative overview of the GGSS ToC.

Context

Items included as part of the context of the ToC can be divided into enablers and barriers to realisation of benefits, and are colour coded accordingly:

- The enabling contexts identified include the current AD biomethane context of high capital and operating costs compared to a gas counterfactual, the need to meet near-term carbon budgets and concern on the impact of biomethane in the absence of support post- ND RHI. Other contexts include wider supportive policies to support biomethane generation and feedstock availability.
- Barriers include supply chain challenges, feedstock competition, planning permission delays and the inflationary context, with the expectation that these would influence applicant decision making and ability to apply.

Inputs

Inputs are divided by government inputs and enabling inputs from the market inputs:

- Government inputs include the cost of tariffs (funded by the GGL) and costs to operate and design policy, as well as wider enabling policy and support.
- Applicants have inputs including preparing applications (including attracting investment, progressing planning) and the wider inputs include feedstock availability and the wider

biomethane industry have provided a source of evidence on costs to support policy design.

Activities

Activities are divided by Ofgem's role and the Department's role:

- For Ofgem, activities are focused on the application assessments, validating and calculating quarterly participant periodic data, ensuring compliance and enabling payments to suppliers.
- The Department for Energy Security and Net Zero's role focuses on budget management, stakeholder engagement and monitoring and evaluation.

Outputs

Outputs relate to the direct results of the GGSS, and the following outputs have been identified for plant deployment, the environment, the market, policy and wider outputs:

- For plant deployment, the payments based on the Tariff Guarantee are expected to improve the rate of return for investors to leverage investment and encourage capital development, and the scheme will drive applications to signal to the market continuity of government support for Biomethane from the ND RHI.
- Environmental outputs relate to ensuring biomethane is sustainable, meeting requirements and is driven by compliance activities and sustainability guidelines.
- Policy outputs relate to the increased visibility of the government in the market as well as capturing additional evidence on the market as it progresses towards self-sustenance. This is driven primarily by monitoring and analysis, as well as the Mid-Scheme review, drawing out key learning on the policy.
- Market outputs derive from the stakeholder engagement activities, driving awareness of the benefits and applications of biomethane (e.g. to new applicants).
- Finally, the flexibility of the scheme to support other outputs contributes towards increased biomethane deployed on the RTFO and for CHP electricity generation (though a CHP-boiler utilising unclaimed biomethane).

Outcomes

Outcomes are similarly divided broadly by deployment, environmental, market and other outcomes, and also capture the disbenefits of the programme:

- AD plant construction will mean more AD plants in the UK are operational and producing biomethane. Outcoems of this vary, including the environmental benefits of displacing natural gas and utilise waste. However, on the other hand, additional plants will mean that land-use may be directed towards supporting energy crops for AD (for the non-waste portion of plant feedstock mix) displacing other social benefits, and natural carbon storage.
- Through increased biomethane used for transport and electricity, the GGSS will contribute towards these sector decarbonisation strategies, and ultimately, incremental increases in system decarbonisation.

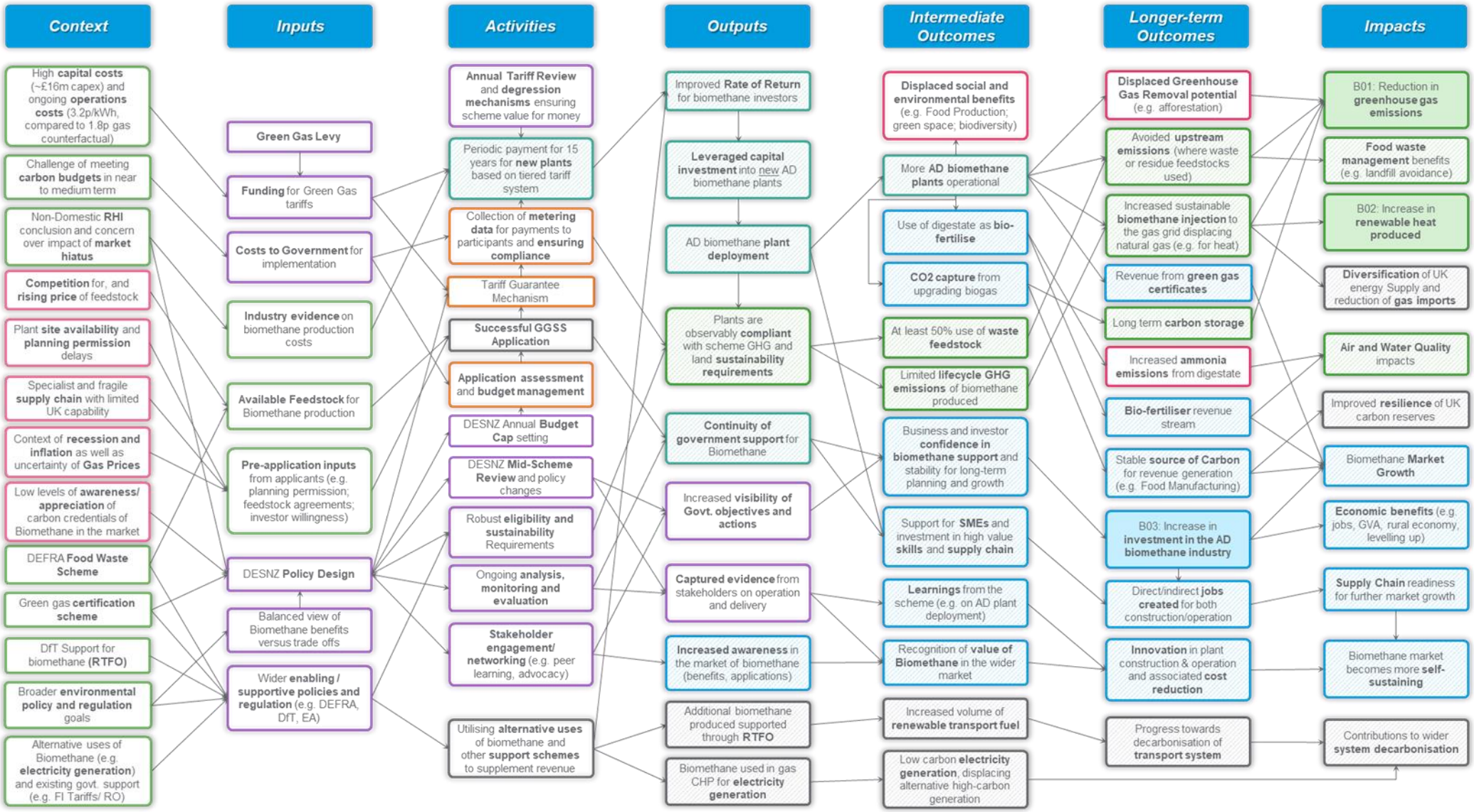
- Environmental outcomes include the increase in waste feedstocks utilisation, and limits on lifetime emissions of the biomethane produced as a consequence of compliance with the sustainability requirements. These outcomes contribute towards avoided upstream and downstream carbon emissions. However, digestate production and deployment may lead to increased ammonia emissions.
- The market outcomes are broad: increased AD plant deployment and operation leads to increased by-products (e.g. digestate for fertiliser, carbon captured) and revenue streams (e.g. green gas certificates). These each provide additional revenue streams for AD plant developers / investors, which is expected to help improve financial viability (and investment potential). Government support for the biomethane market is also expected to lead to increased confidence from investors and businesses, again supporting investment in the market. Opportunities for SMEs (protecting skills and jobs) and innovative business models (to increase returns) are also anticipated to lead to market development and growth.

Impacts

The impacts are structured by the three core objectives of the GGSS (B01, B02 and B03) and are subdivided into environmental, economic/market, and secondary effects.

- **B01** is a reduction in greenhouse gas emissions as a result of displacing natural gas with biomethane in the gas grid, as well as avoiding upstream emissions, meaning organic waste no longer ends up in landfill (where it will decompose and release CO2 or methane into the atmosphere.
- **B02** is an increase in renewable heat as a consequence of increased biomethane injection, directly replacing natural gas used for heating.
- Other environmental benefits of increased biomethane generation include better food-waste management; although also include the costs of air and water quality issues from potential increases in ammonia emissions.
- Flowing through from **B03**, which is an increase in investment in the AD Biomethane industry are impacts on the wider biomethane market, including expected growth from increased new plant deployment, improved UK supply chain to meet further growth, economic benefits for rural economies.

Figure 5: GGSS Theory of Change Diagram



GGSS Theory of Change: Assumptions and Risks

A key aspect of a ToC is profiling the assumptions that are made about the expected causal linkages, and the associated risks of inadequate assumptions. We have profiled the assumptions and risks made at different points of the overall Theory of Change.

Context and Inputs

Assumptions

- There is sufficient demand for the scheme from applicants.
- Feedstock is available and at a financially viable price.
- DEFRA food waste policies provide impetus to apply.

Risks

- Risk of fraud from plants.
- Scheme uptake is low.
- Budget cap constrains deployable plants.
- Supply chain issues constrain deployment.
- Delays to DEFRA food waste policies.

Activities and Outputs

Assumptions

- New plants won't be deployed without intervention.
- Confidence in support/business model leverages sufficient capital.
- Annual tariffs appropriately set to incentivise deployment and ensure value for money.

Risks

- Plants are overcompensated (e.g. double subsidy with RTFO, high tariff rates, high gas prices).
- Construction prices impact financial viability.
- Ofgem unable to effectively deliver scheme.
- Plants are unable to deploy within their stated injection start date, plus the 182-day grace period.
- Tariff rates do not incentivise applications.

Outcomes and Impacts

Assumptions

- Gas Network has sufficient capacity / connection quality.
- Sufficient waste feedstock can be accessed.
- Increased deployment of plants leads to wider supply chain and market growth.
- Sustainability requirements are adhered to.
- Plants connect to low-pressure gas network, therefore contributing to heat decarbonisation.

Risks

- AD plants may be outcompeted for non-waste feedstock (e.g. increasing demand for bioenergy with carbon capture and storage (BECCS); improved financial viability of land-based greenhouse gas removal (e.g. through carbon pricing)).
- Green gas injection is lower than expected.
- Negative carbon impacts in biomethane production (e.g. leakage).

GGL Theory of Change

The ToC for the GGL evaluation was developed 'bottom up' by the evaluation team, through detailed document review, scoping interviews with the relevant department policy team, and a theory-building workshop event. It is presented in Figure 6, and the associated assumptions and risks are listed on the subsequent page.

Context

As in the GGSS ToC, the GGL ToC context section includes both barriers and enablers to the implementation of the GGL.

- The enablers and contextual factors driving the GGL include a need to fund the GGSS biomethane injection from sources beyond that of the Treasury, which held the position that biomethane funding would not be from the Exchequer, post the closure of the RHI. With examples of legislation in place and levies enacted for electricity supply, these also supported the development of the GGL.
- On barriers, the ToC highlights the context of financial pressures amongst gas suppliers, driven by wholesale gas price rises at the time of developing the ToC. This context saw a number of UK suppliers failing (in 2021 and 2022). Added to this context is the wider economic context of inflation and recession, expected to also have an impact on gas supplier stability.

Inputs

Inputs cover levy design, policy inputs, and inputs relating to deliver.

- On levy design, the ToC highlights how the GGL design phase brought together evidence from previous levies, expert opinions, and a set of principles for the new levy. Inputs also included understanding the market processes, an understanding of the

number of meter points in the market and an understanding of the level of green gas delivered by suppliers (to help set up the exemption).

- On policy inputs, the GGL draws on the GGSS deployment estimates (and resulting budget cap) to help with the setting of the levy rate. The Annual Budget for the GGSS will have headroom built in (based on the amount of risk that policymakers are willing to take) to provide the annual Overall Scheme Expenditure Budget cap, which informs the levy rate.
- Finally included in the input is the actual cost of administering the levy (by Ofgem) and the systems to enable the administration.

Activities

Activities broadly divide into controlling the levy rate, collecting payments (as well as ensuring compliance), and gathering evidence.

- The ToC highlights how the levy rate estimated is confirmed with the Treasury ahead of the levy rate confirmation for the financial year (occurring a quarter before the financial year commences). It also highlights the actions of the Department, Ofgem and the Treasury in holding over any surplus levy collected (due to lower payments on the GGSS) to inform the next year's levy.
- The activities for Ofgem/gas suppliers in calculating levy amounts due for each supplier, ensuring payment and compliance is also highlighted. The ToC shows the process where suppliers pay the levy rate per gas meter they serve, per day, and also details the process of ensuring compliance (lodging credit cover to cover payments) and the measures taken to ensure compliance (communication and more punitive measures e.g. naming non-compliant suppliers).
- Finally, the levy is subject to ongoing monitoring and evaluation to capture evidence.

Outputs

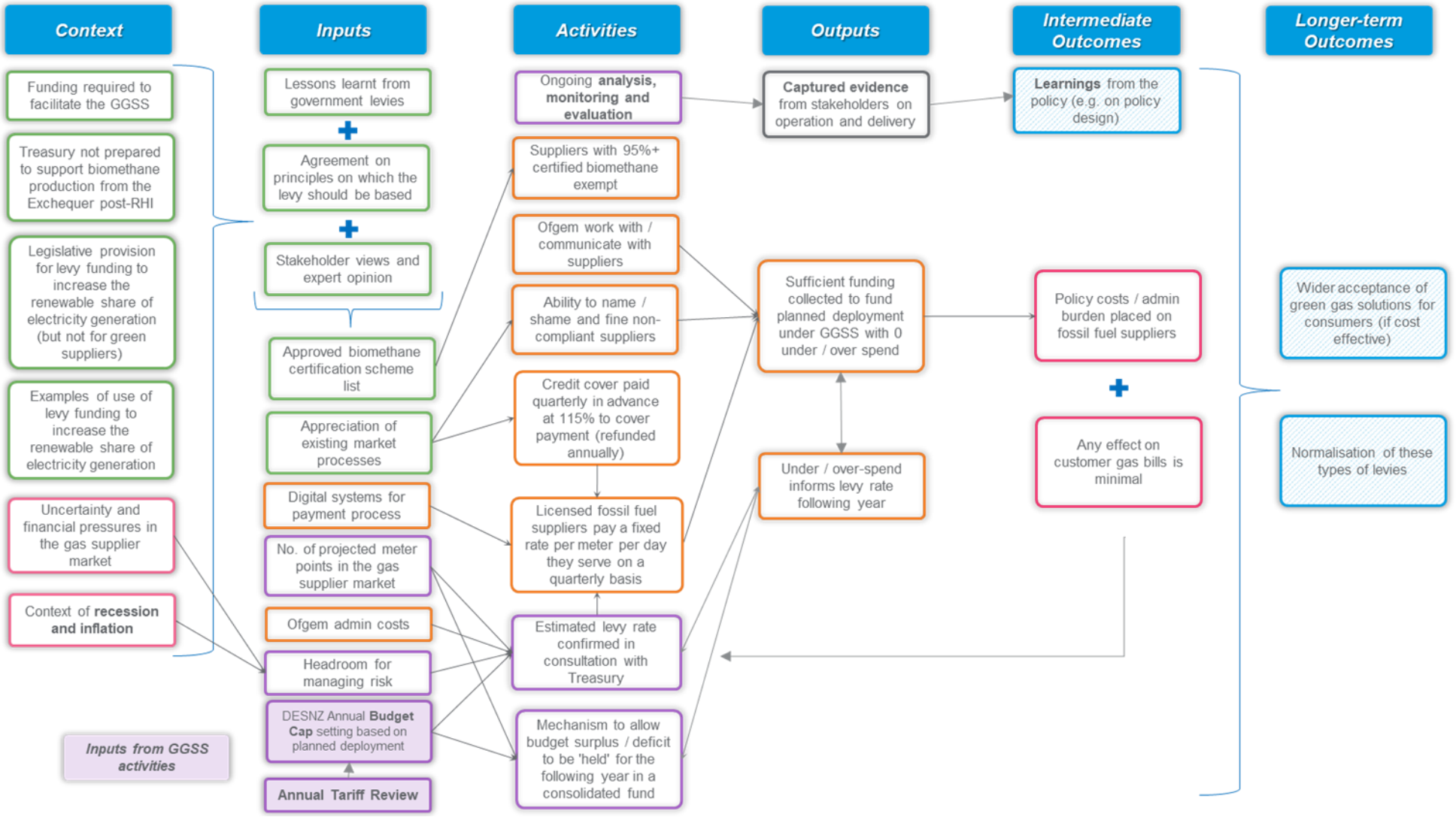
Given the sole objective of the GGL is to fund the GGSS, there are few outputs from activities beyond the GGL covering GGSS costs (plus Ofgem costs), with no over or underspend. This is driven by the levy setting process and supplier compliance with payments. Any over or underspend that does occur is fed back into the levy setting process for the following year. The only other outcome relates to the monitoring activities, which lead to new evidence on operation and delivery of the levy.

Outcomes

Finally, the ToC includes a number of intermediate, and longer-term outcomes.

- In the shorter term, the outcomes of the levy are generally negative, in that the cost of administration is placed on suppliers and are likely to feed into consumer bills. Although one more positive outcome is the learning from GGL on levy policy design.
- In the longer term, it is assumed that the levy may drive wider acceptance of these sort of solutions, as well as normalise green levies on gas.

Figure 6: Green Gas Levy Theory of Change



GGL Theory of Change: Assumptions and Risks

Context, Inputs and Activities:

Assumptions

- Sufficient lead time to ensure gas suppliers can prepare for payment of the levy.
- Levy funds the full costs of the scheme, including all payments to participants, Ofgem administration costs, and to cover overspend and under-collection risks.
- Flat rate mechanism approved on the agreement that would move to a volumetric rate as soon as feasibly possible.
- Policy design minimises non-compliance.
- Ofgem systems effective to minimise deficits and delays.
- Relatively low proportion of the market are exempt from levy.

Risks

- Budget deficit.
- Budget surplus.
- Levy is not paid in the instance a supplier becomes insolvent.
- Ofgem insufficient money to pay GGSS.

Output and Outcomes:

Assumptions

- Policy costs / admin burden placed on fossil fuel suppliers is minimal and comfortably tolerated.
- Increased gas bill for customers is minimal and comfortably tolerated.
- Costs are passed onto customers (cost currently met by government as it is factored into energy price guarantee).

Risks

- Fuel poverty and specific impacts contained within the Small and Micro Business Assessment (SaMBA).

Contribution Claims

As part of the evaluation's approach to test and validate the Theory of Change, a set of thirteen contribution claims have been identified. Contribution claims draw on the Theory of Change and existing evidence to assemble hypotheses for how an intervention delivers outcomes and

impacts and were developed collaboratively with the Department for Energy Security and Net Zero as part of the theory development workshop. The set of contribution claims contains a causal hypothesis of how it is theorised that the scheme will deliver impact, a counterhypothesis of alternative plausible explanations of how impacts might occur, and the evidence that is expected for each claim. These are presented below.

GGSS CC1 (B01)

- *Casual Hypothesis:* Guaranteeing the revenue stream of AD plants for 15 years incentivises their deployment and operation. This in turn increases the volume of new biomethane coming online (to at least the lower range of expected deployment in the Impact Assessment) in order to effectively contribute to carbon budget targets and provide cost-effective decarbonisation.
- *Counterhypothesis:* Movement in relative energy prices and industry appetite leads to increased biomethane deployment.
- *Expected Evidence:* Plant reporting on volume of biomethane produced / volume of biomethane claimed for tariff payments.

GGSS CC2 (B01)

- *Casual Hypothesis:* Through effective policy design and implementation measures (including those intended to ensure compliance), and in order to receive the payment for injection, plants must comply with lifecycle emissions (sustainability) requirements and ensure greenhouse gas emissions from bio generation do not exceed the threshold level. This means that emissions reduction benefits are not offset by emissions in biomethane production (e.g. through leakage).
- *Counterhypothesis:* Scheme mechanisms fall short of ensuring lifecycle emission compliance, and emissions reductions from green gas injection displacing natural gas are overestimated.
- *Expected Evidence:* Audit data on lifecycle emissions.

GGSS CC3 (B01)

- *Casual Hypothesis:* Where plants have access to and utilise waste feedstocks (e.g. through Defra food waste policies) GGSS requirements (of at least 50% waste feedstocks to be eligible to receive GGSS tariff) mean that waste and residues are utilised within new AD plants as they become operational. As a result, potential upstream emissions (e.g. through landfill and therefore methane release) are avoided.
- *Counterhypothesis:* Scheme mechanisms fall short of ensuring feedstock compliance, and benefits from waste feedstock are overestimated.
- *Expected Evidence:* Annual sustainability audit report on land criteria; survey evidence (feedstocks etc.).

GGSS CC4 (B02)

- *Casual Hypothesis:* The GGSS enables new AD plants (where they have secured feedstock supply, a suitable site, and the ability to build a plant) by supporting the case for investment, enabling plants to become operational and therefore inject biomethane into low-pressure distribution networks used for home and business heating, and thus contributing toward renewable heat generation in the UK.
- *Counterhypothesis:* Alternative biomethane uses mean large amounts of green gas is used for transport and electricity decarbonisation.
- *Expected Evidence:* Stated amount of Biomethane claimed under GGSS and RTFO; information gas grid connection.

GGSS CC5 (B03)

- *Casual Hypothesis:* GGSS tariff rates are set and monitored to enable prospective AD plant developers to implement a business model that provides an appropriate rate of return to secure private investment in AD plant construction, leading to new AD plants deploying.
- *Counterhypothesis:* [e.g.] Scheme mechanism design fails to appropriately set tariff rates / technical, or business model innovation means biomethane can be produced at lower cost, leading to over-subsidising biomethane / challenges in accessing feedstock mean cost to produce biomethane increases and ROR is lessened.
- *Expected Evidence:* GGSS Tariff setting model; evidence from plants.

GGSS CC6 (B03)

- *Casual Hypothesis:* In affirming the government's supportive position through continued funding for biomethane production and injection, as well as increased visibility of the benefits from biomethane more broadly, developers and investors within the sector have the confidence to continue operating in the sector on a long-term basis and others have the confidence to enter, growing the market.
- *Counterhypothesis:* Rise in green financing / ESG investing leads to biomethane market growth / Plants rely on international skills and supply chains for construction and operation of plants, meaning UK market see no growth.
- *Expected Evidence:* No. of jobs and businesses and sector GVA; qualitative evidence on market value.

GGSS CC7 (B03)

- *Casual Hypothesis:* By ensuring continued government support for biomethane production, supply chains and AD plant developers maintain the confidence to continue in the market and grow to meet opportunity. In turn, the UK AD sector retains and grows the required skills and expertise, meaning that required resources are in place (and at a reduced cost due to competition) to enable wider market growth.

- *Counterhypothesis:* Demand from ND RHI scheme and Biogas CHP deployment ensures sector continues to support local skills and supply chains.
- *Expected Evidence: Expected Evidence:* Qualitative evidence.

GGSS CC8 (B03)

- *Casual Hypothesis:* The design of tariff tiers and the limited availability (and increasing cost) of feedstock encourages developers to test business models to provide greater efficiencies and revenues. This practice, facilitated by knowledge sharing, leads to cost savings in biomethane production and improved returns, and therefore a less subsidy-dependent market.
- *Counterhypothesis:* Biomethane production is already heterogeneous and innovative approaches that improve financial viability occur through market forces.
- *Expected Evidence:* Qualitative Evidence.

GGL CC1

- *Casual Hypothesis:* Fossil fuel gas suppliers are charged a levy per meter point each supplier serves. Through effective policy design, intelligence on the number of projected meter points being served, and accurate deployment forecasts for the GGSS, the Green Gas Levy rate is set appropriately such that it collects sufficient money to fund the GGSS with no under- or over- spend between the years 2022 – 2043/44.
- *Counterhypothesis:* Additional mechanisms are required to cover the costs of the GGSS.
- *Expected Evidence:* Monitoring data on under/overspend.

GGL CC2

- *Casual Hypothesis:* Effective policy design provides the necessary headroom, payment in advance, compliance and surplus management mechanisms. Therefore the Department has confidence the Green Gas Levy will collect sufficient money to fund the GGSS.
- *Counterhypothesis:* The Green Gas Levy requires redesign and / or additional mechanisms are required to cover the costs of the GGSS.
- *Expected Evidence:* Qualitative evidence from gas suppliers and the Department.

GGL CC3

- *Casual Hypothesis:* By designing mechanisms to reduce the overall administrative burden, taking a relationship-focused approach to engage with suppliers, and effective enforcement strategies, gas suppliers comply with their GGL obligations.
- *Counterhypothesis:* The Green Gas Levy requires redesign and / or additional mechanisms are required to cover the costs of the GGSS.
- *Expected Evidence:* Qualitative evidence from gas suppliers.

GGL CC4

- *Casual Hypothesis:* By managing the available budget for the GGSS through annual caps, after which applicants are placed in a queue, the total impact of the GGL on consumer gas bills is kept to an acceptable level while still enabling the GGSS to be fully funded.
- *Counterhypothesis:* The Green Gas Levy requires redesign and / or additional mechanisms are required to cover the costs of the GGSS.
- *Expected Evidence:* Qualitative evidence from gas suppliers and the Department; Modelled impact on consumer gas bills, monitoring data.

GGL CC5

- *Casual Hypothesis:* The experience of the Green Gas Levy normalises this sort of levy on fossil fuel suppliers and provides the Department with the necessary experience to design and develop further gas levies in the future.
- *Counterhypothesis:* Treasury need to fund initiatives to reduce greenhouse gas Emissions.
- *Expected Evidence:* Qualitative evidence from government and Ofgem.

Annex 4: Research Tools

This Annex presents the key research tools used as part of the evaluation to date: the GGSS and GGL process maps, developed following our review of available evidence; the topic guides that were used to structure stakeholder interviews; and the survey questionnaire.

GGSS and GGL Process Maps

Process mapping was carried out as part of our GGL and first GGSS process evaluation workstreams. The process maps provide a framework through which the respective scheme processes have been analysed and seek to understand what works well and less well at different points in the journey. Figure 7, Figure 8 and Figure 9 show the process map developed for the GGSS, Figure 10 and Figure 11 presents the equivalent map developed for the GGL process evaluation.

Figure 7: GGSS Process Map

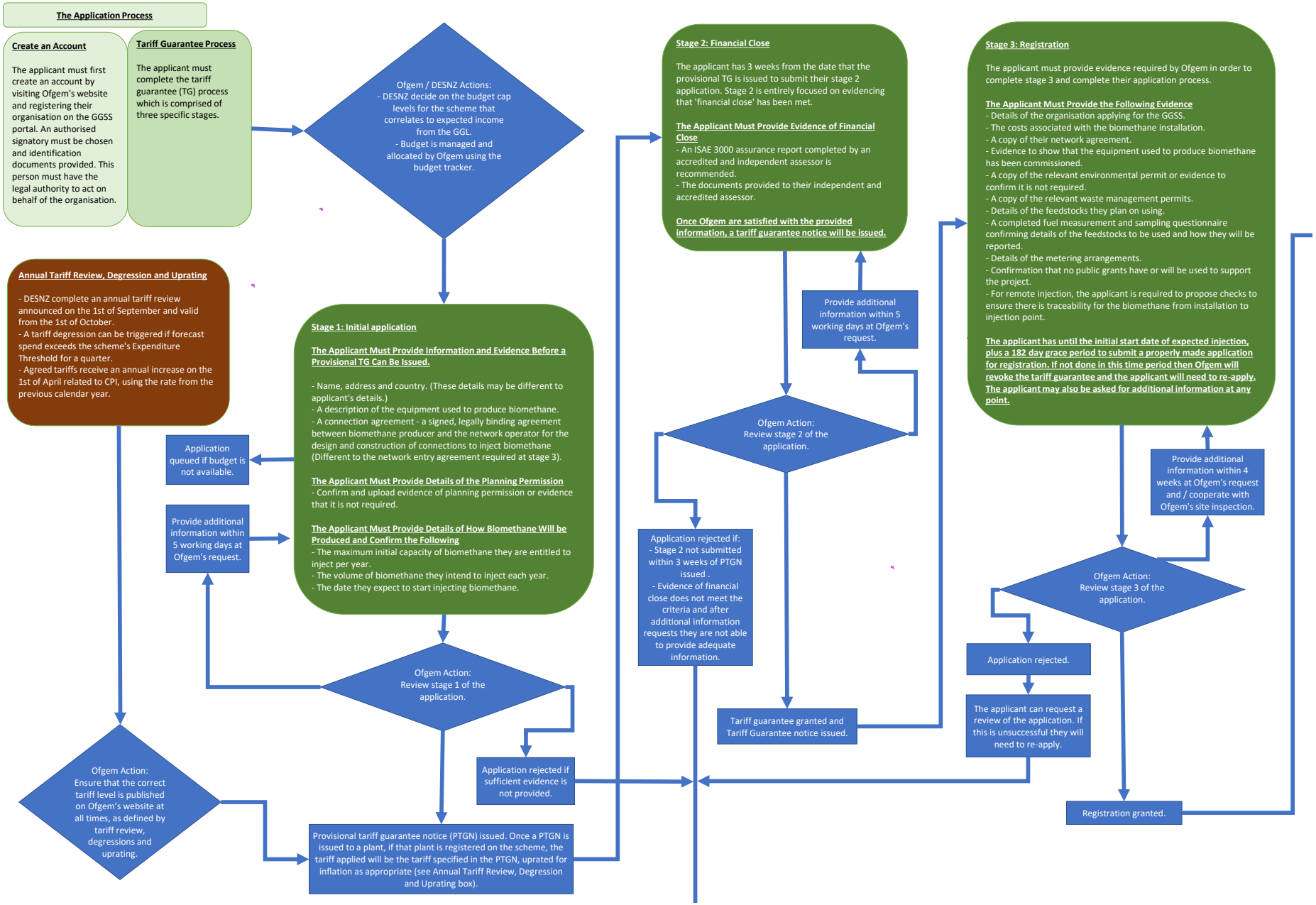


Figure 8: GGSS Process Map (continued, below)

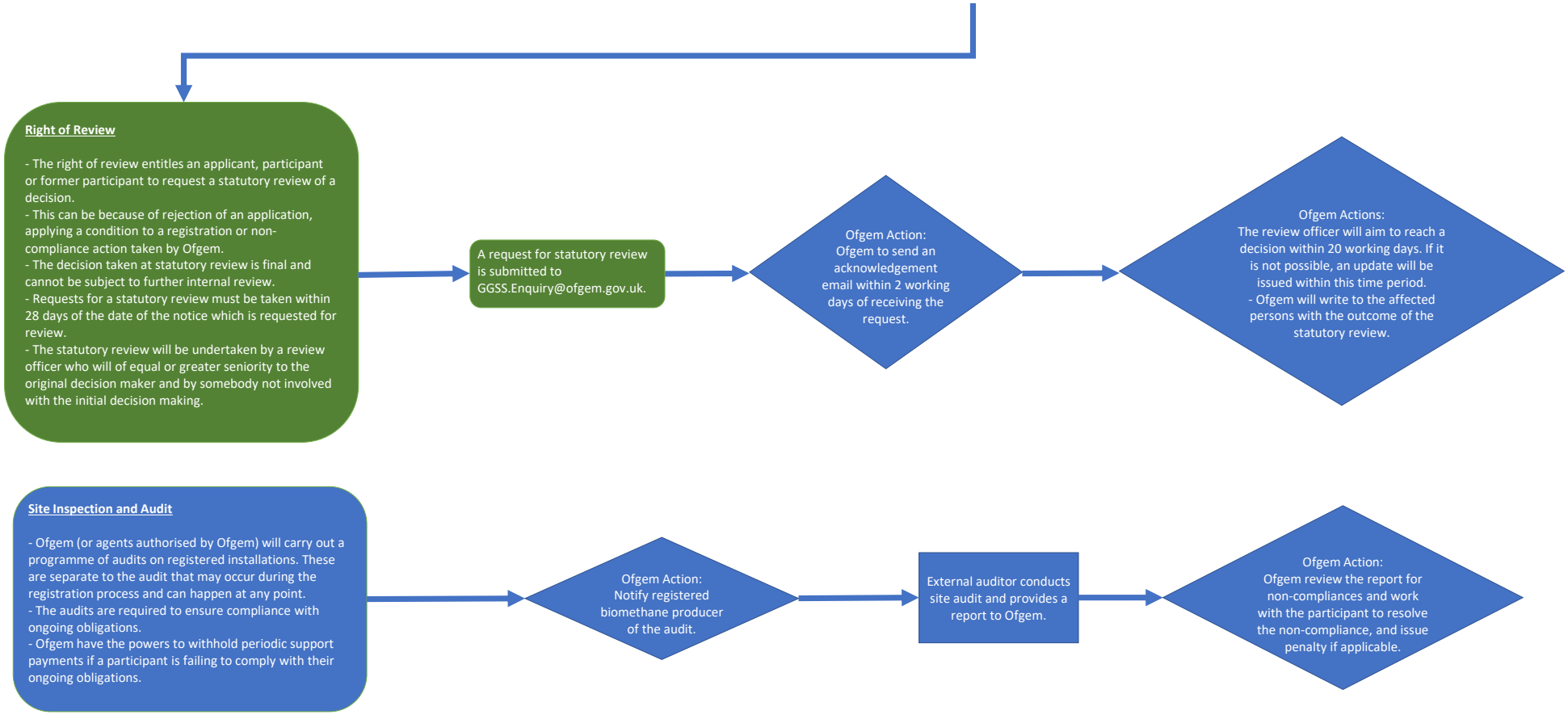


Figure 9: GGSS Process Map (continued, right)

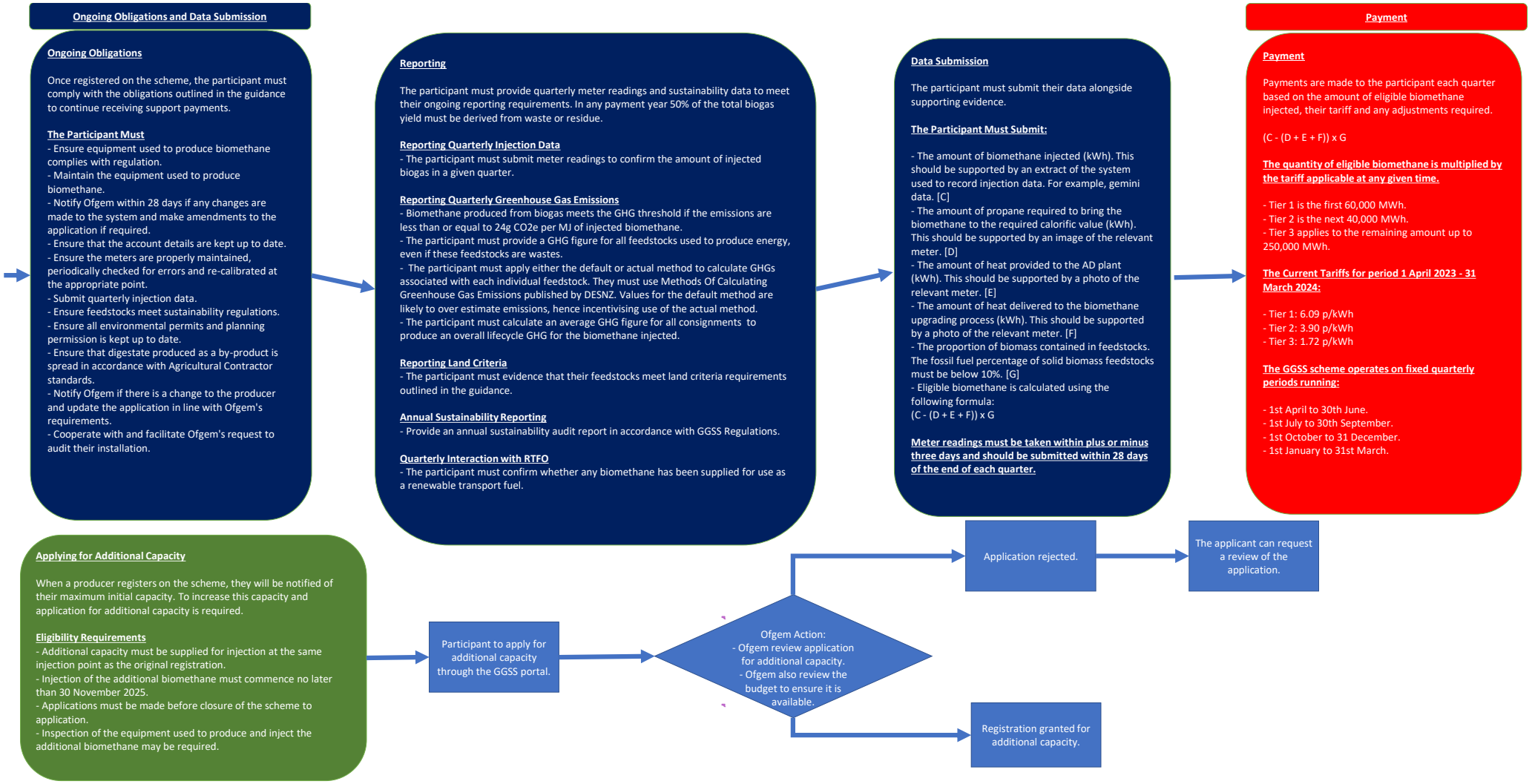


Figure 10: GGL Process Map

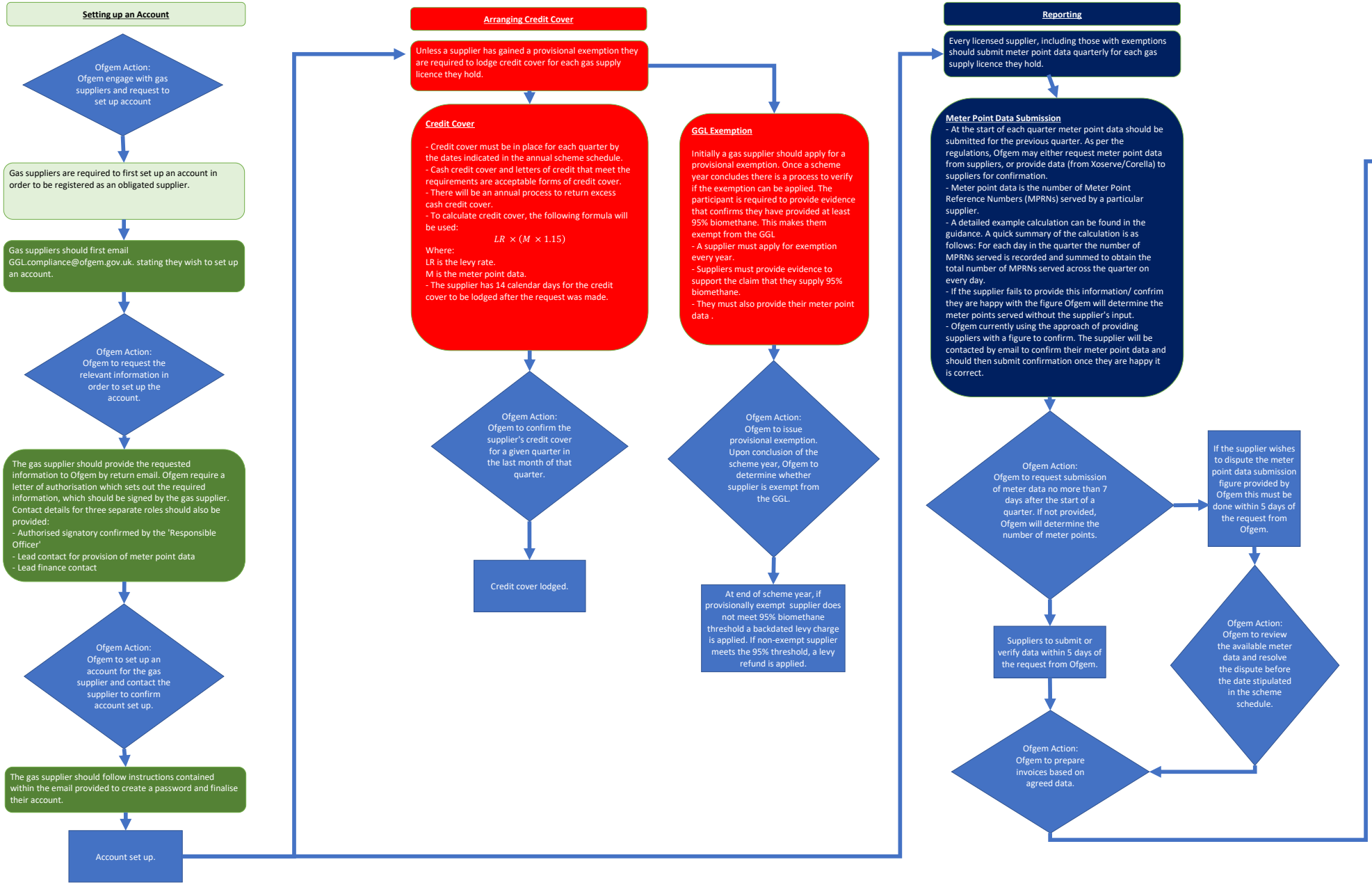
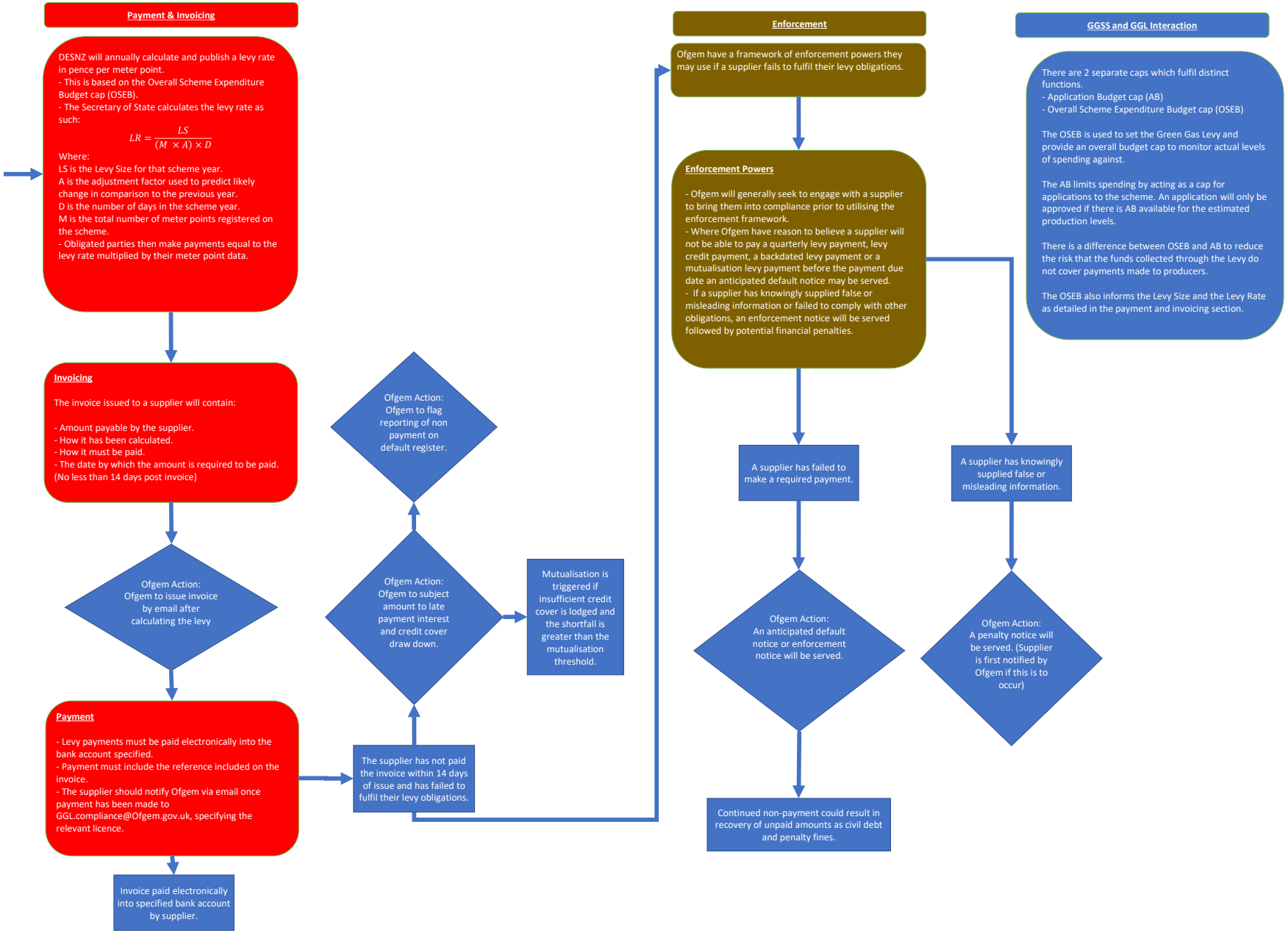


Figure 11: GGL Process Map (continued, right)



GGSS and GGL Topic Guides

Topic guides were developed and used to structure qualitative stakeholder interviews. The Topic guides translate Evaluation Questions into interview questions structured around ToC elements relevant to the workstream and stakeholder group concerned. In this section, the Topic Guides that were used for the GGSS successful applicant consultations and the GGL gas supplier consultations are presented. Other topic guides, including those used for consultations with representatives from the Department, Ofgem, unsuccessful GGSS applicants and GGSS non-applicants, were also developed and utilised in stakeholder interviews. The two demonstrated below serve as examples of the format these guides are presented in.

Example Topic Guide: GGSS Successful Applicants

Introduction and evaluation background

RSM UK has been commissioned by DESNZ to evaluate the Green Gas Support Scheme (GGSS) and Green Gas Levy (GGL). The overarching evaluation work began in November 2022 and will be finalised in May 2026. The work comprises workstreams that cover both process evaluation and impact evaluation that aim to assess performance of the scheme and levy.

This interview focuses on the process aspects of the GGSS, and addresses the three main process evaluation questions, which focus on: the effectiveness of the implementation and delivery of the GGSS scheme, its budget management, and the interaction between the GGSS and similar related policies. Please note, this work is not related to any audit or compliance activities and is completely independent of administration of the scheme. We expect the interview to last for up to one hour.

Data and confidentiality

Your contributions to this study are strictly confidential and will not be associated with either your name or the name of your organisation without your explicit consent. All reporting will be done at the highest level of aggregation, and your answers will only be used for the purpose of this evaluation. You have the right to withdraw your participation at any time.

The data from this interview, combined with the research from our other research activities will be used to produce a report for the Department, which they may publish. We may wish to use quotes from your interview responses to illustrate parts of the analysis, but if we do so, this will be anonymised and non-identifiable. In situations where non-personal data information in the reporting specifically identifies an organisation, we will provide draft text to you for approval.

Consent to transcribe

With your permission, we would like to transcribe this interview to enable an accurate record of the discussion. This will be undertaken via the Microsoft Teams auto-transcription service. Data collected and transcribed will be anonymised and stored in accordance with legal

requirements and the General Data Protection Regulations (GDPR). All collected data will be destroyed on completion and sign off of the evaluation.

Do you consent to transcription on this basis? Yes / No [Delete as appropriate]

Consultation questions

Overall view of GGSS and motivations for applying: This initial section of the interview will provide an overview of how you have understood the aims of the GGSS and your motivations for applying.

1. Can you describe your understanding of the GGSS and what its specific aims are?

- Prompt: Did any aspects of the scheme particularly resonate with you, or seem particularly beneficial for you?

2. What were your specific motivations for applying for the scheme?

- Prompt for: How long have you considered developing an AD biomethane plant?
- Prompt for: What has your involvement been with the biomethane industry prior to applying?

Experience of the application process: We will now focus on your experience of applying to the GGSS – focusing on the processes, requirements, support, and challenges.

3. What was your experience of providing the inputs required at Stage 1 and 2 of the GGSS application process? Were any specific requirements of the application particularly burdensome or difficult to obtain?

- Prompt for: planning permission and siting requirements; feedstock agreements with feedstock suppliers / identification of available feedstock; securing capital investment for construction?

4. Do you think the requirements at Stage 1 and 2 of the application are proportionate to the support that is provided by the scheme? Did these requirements match your expectations of what would be required to apply?

5. How would you describe your overall experience of the application process?

- Prompt for: What worked well?
- Prompt for: What worked less well?
- Prompt for: How helpful was Ofgem's GGSS guidance document when completing your application? *Please also further explore any areas which are noted as not being helpful.*

6. What is your view of the GGSS eligibility and sustainability requirements (e.g. feedstock requirements, sustainability requirements)?

- Prompt for: Were there any requirements that you were unaware of before applying?

- Prompt for: Did any eligibility / sustainability requirement act as a particular barrier to your application?
- Prompt for: What, if any, changes to the eligibility and sustainability criteria would you make to enable more projects to come forward?

7. What, if anything, would you change about the application process?

Barriers to application: We will now move on to consider if there were any challenges or barriers that may have prevented you from applying.

8. Did you experience any challenges or barriers in your decision to apply, related to external or contextual factors (i.e. not directly related to scheme processes)?

- Prompt for: awareness/appreciation of carbon credentials of biomethane in the market; the current macroeconomic climate (i.e. recession concerns, high inflation, high interest rate); supply chain issues and/or changing prices in UK wholesale gas sales, digestate sales?

9. To what extent were you able to mitigate these challenges or barriers through the GGSS application process or through participation in the scheme?

Experience of administration (including payment processes): We will now move on to focus on your experience following your successful application. We recognise that given the short timeframe from which your application was approved, there may be some aspects of these questions that may be difficult to answer in full. Please feel free to let us know if you are unable to comment on any specific area.

10. How would you describe your overall experience of the GGSS delivery/administration post-application?

- Prompt for: What has worked well?
- Prompt for: What has worked less well?

11. Have the processes of metering data collection and tariff payment been straightforward? Have there been any challenges or issues in this process?

Note to interviewer: it is unlikely that we will be able to collect feedback on payments specifically given that the first quarterly submission is only due end of January and payment will be made shortly after if participant data is on time and correct

Note to interviewer: Ensure participants are clear on whether their feedback relates to metering data collection or payment processes

- Prompt for: Are you satisfied with the payments processes by Ofgem?
- Prompt for: Have you found the digital systems to support such payment processes to be easy to use?

- Prompt for: Are there any ways in which these processes could be improved / made more efficient?

12. How would you describe the effort and cost associated with meeting ongoing reporting requirements (e.g. metering, sustainability audit reporting)?

- Prompt for: What monitoring data is requested? How accessible is this data to you? Did any area incur additional effort or cost?
- Prompt for: Were you able to use pre-existing data to meet reporting requirements or do you undertake additional data-gathering processes to gather evidence required?
- Prompt for: Does the level of effort and cost required to provide such data match the expectations you had prior to your application?

13. Are there any additional elements of the administration of the scheme that could be improved?

- Prompt for: Communications; data collection; monitoring and reporting; administrative burden

Experiences of GGSS budget management mechanisms: We will now move on to think about the financial management systems of the scheme and your experience of these.

Note to interviewer: the GGSS's budget management has been designed to minimise the risk of overspend on the scheme relative to the amount collected by the Green Gas Levy. If the levy collects more than is needed in a given year, the surplus is rolled over to fund the scheme in the following year. The key mechanisms include Budget Caps, the Annual Tariff Review, and Degression. Processes to support budget management also includes forecasting for deployment, estimating payments to biomethane plants.

14. How appropriate is the tiered tariff system within the GGSS to ensure fair payments to participants?

- Prompt for: Do the differences between tariff levels appropriately reflect cost advantages from economies of scale in biomethane production?
- Prompt for: How did the tariff tiering system impact on your decision to apply, if it did?
- [For participants that have responded to the last ATR consultation only – note that interviewer will need to check this prior to the interview] Prompt for: Are there any additional factors which should be considered in relation to the annual tariff review?

15. How do you view the GGSS budget management mechanisms (e.g. ATR, Budget caps, degression)?

- Prompt for: Did aspects of budget management (such as budget caps) influence your view of the scheme prior to application?
- Prompt for: Are budget management mechanisms likely to pose a barrier to other organisations considering a GGSS application?

Interaction between the GGSS and other policies / schemes: As we come towards the end of this interview, we want to explore the influence that wider policy / programmes may have had on your experience and decision making.

16. Did any other government policies or schemes provide you with additional confidence to apply to the GGSS?

- Prompt for: Schemes such as: Renewable Transport Fuel Obligation Prompt for: Are there other policy signals from government relating to biomethane support that would provide additional market confidence / impetus to apply?

17. Are there any learning points or efficiencies that you think could be applied to GGSS, based on your engagement with other schemes / policies?

- Prompt for: Concrete examples

Testing relevant contribution claims: We will conclude with questions that relate to our 'theories' of how the GGSS works and use your response to assess their accuracy.

Note to interviewer: While contribution claims are tested 'in aggregate' during the analysis of collected data, it is important to test the developed causal hypotheses as part of consultation too. As such, we have translated the causal hypotheses into questions for this final part of the interview.

18. Regarding lifecycle emissions from biogeneration, how have you ensured, and demonstrated to Ofgem, that greenhouse gas emissions remain below threshold levels, as set out in the sustainability requirements?

19. What has your experience been of accessing waste feedstock? Has it been easy to source, transport and use for biogeneration? What proportion of feedstock is from waste and is this likely to change?

20. Are tariff levels for the GGSS set at an appropriate level to encourage further application to the scheme?

- Prompt for: Have you experienced any challenges regarding the current tariff levels in meeting an acceptable RoR?

Final remarks

21. Are there any other points that you would like to raise?

Example Topic Guide: Gas Suppliers

Introduction and evaluation background

RSM UK has been commissioned by the Department of Energy Security and Net Zero to evaluate the Green Gas Support Scheme (GGSS) and Green Gas Levy (GGL). The overarching evaluation work began in November 2022, and will be finalised in May 2026. The work comprises workstreams that cover process evaluation (how the Scheme and levy have

worked) and an impact evaluation (what has happened as a result of the Scheme and levy). This interview is part of our process evaluation of the Green Gas Levy and will focus on the effectiveness of levy implementation and administration. We expect the interview to last for up to one hour.

Data and confidentiality

Your contributions to this study are strictly confidential and will not be associated with either your name or the name of your organisation without your explicit consent. All reporting will be done at the highest level of aggregation, and your answers will only be used for the purpose of this evaluation. An evaluation report may be published, but your anonymity will still be protected. You have the right to withdraw your participation at any time.

Consent to transcribe

With your permission, we would like to transcribe this interview to enable an accurate record of the discussion. This will be undertaken via the Microsoft Teams auto-transcription service. Data collected and transcribed will be anonymised and stored in accordance with legal requirements and the General Data Protection Regulations (GDPR). All collected data will be destroyed on completion and sign off of the evaluation.

Do you consent to transcription on this basis? Yes / No [Delete as appropriate]

Consultation Questions

Introduction

1. Can you describe your role and your interactions with the Green Gas Levy?

Communication of and guidance on the levy to Suppliers

2. How were the requirements of the Green Gas Levy communicated to you?

- Prompt for: To what extent communications on the levy have provided clarity to meet the organisation's needs
- Prompt for: Appropriateness of timing of communications in relation to opportunity for organisations to prepare

3. Have you used Ofgem's online guidance on the levy and how useful did you find this guidance? (Note: guidance includes webpage and 80 page PDF document).

- – Prompt for: what the guidance was used for specifically?
- – Prompt for: was the guidance itself sufficient?

4. Are any improvements necessary to the ongoing communications and guidance regarding the levy to provide you with more clarity and / or support to meet your obligations under the levy?

Implementation of the Green Gas Levy

5. What has your experience been of providing quarterly meter point data?

- Prompt for: have Ofgem processes for submitting this information been straightforward to use and worked as you would expect?

6. What has your experience been of the process of providing payment of the levy to Ofgem?

- Prompt for: Credit cover requirements

7. Do the levy processes allow enough time for your organisation to meet the requirements of the levy?

- Prompt for: timings for paying levy, lodging credit cover, paying mutualisation costs, paying penalties?

8. To what extent are you satisfied with how Ofgem have implemented the Green Gas Levy?

- Prompt for: Anything Ofgem are doing particularly well that has smoothed the process?
- Prompt for: Any improvements to be made in how the levy is implemented / administered?

Costs to suppliers

9. Can you describe the costs to your organisation of compliance with the levy in terms of financial aspects and administrative effort?

- Prompt for: The specific features of levy compliance which incur a cost for the organisation
- Prompt for: Scale of costs or administrative effort experienced (staff time / cash)
- Prompt for: Proportionality of costs / administrative effort with the size of the levy

10. Has compliance with the levy or any aspects of it, been burdensome to your organisation?

- If yes: Could any improvements or changes be made that would ‘smooth’ the process and/or reduce the burden?

11. [Exclude for exempt suppliers] Are the costs of the levy passed on to customers, and if so, by what method are these costs passed on to customers?

- Prompt for: Specific aspects of levy costs
- Prompt for: Routes and mechanisms through which this is undertaken

[Examples to help interviewer understand the type of information sought: are costs shared equally across all customers, or only to some? Do the add costs to standing charges or via higher tariffs or via another way? Do the ensure they collect it in advance or keep reserves?]

12. [For suppliers that are exempt from paying the levy due to 95% certified biomethane only] What has your experience been of providing the necessary evidence to confirm exemption?

- Prompt for: Any challenges in this process?

- Prompt for: General reflections on the 95% threshold for exemption

Energy Price Guarantee

[Exclude for exempt suppliers] Interviewer: As Green Gas Levy costs to suppliers have been covered by HM Treasury as part of the Energy Price Guarantee, we are interested in the impact of the Energy Price Guarantee on Green Gas Levy processes.

13. In what way is the money received by your organisation from the Energy Price Guarantee being used?

- Prompt for: Whether money is used to specifically pay the levy, reduce bills at a flat rate, or used in another way?

14. How, and in what ways, have you communicated this to customers?

- Prompt for: If and how the Green Gas Levy itself and/or the role of the Energy Price Guarantee in covering costs has been communicated to customers

Final remarks

15. Are there any other points that you would like to raise?

Pulse Survey Questionnaire

The questions that were developed for our first Annual Survey of AD Plants are presented below, alongside the area of inquiry that each question corresponds to, and the types of responses that survey participants could provide.

Survey Text

Employment (numbers)

On 31st March 2023, what was the number of employees for the business (FTEs)?

- a) Please indicate the total FTEs paid directly from the business payroll. (Open End) b) Don't know c) Prefer not to say

Employment (skills) Which of the following are skills that employees in this AD/biomethane plant (in aggregate) had in the financial year 2022-2023? Select one option per row.

- a) Biomethane grid injection b) Feedstock mix c) Understanding of plant operation d) Operational procedures e) Health and safety f) Legislation g) Digestate processing technologies h) Digitisation i) Other
- i) Sufficient skills in the plant ii) Further skill development required iii) Don't know iv) Prefer not to say v) Not Applicable

Employment (wages)

What was your business's expenditure on employment costs for this plant in the financial year 2022-2023?

- (i) Wages and salaries are defined as the total compensation in cash or in-kind payable to all employees. State the amount paid before deductions but less any amounts for which you are reimbursed from government sources.
- a) Please indicate the total expenditure (£s) (Open End) b) Don't know c) Prefer not to say

Feedstock (volume) What was the total volume of feedstock processed by your plant in the financial year 2022-2023? This should include all material that is later rejected or excluded from processing.

- a) Please indicate the total volume (tonnes of dry matter equivalent) (Open End) b) Don't know c) Prefer not to say

Feedstock (volume and type)

Please can you tell me how much of the answer given in q4 was each of the following in the financial year 2022-2023. Please enter the value zero ("0") if your plant did not use feedstock from a particular source. Tonnes should be 'tonnes of dry matter equivalent.

Please note that the sum of the figures provided in response to this question should add up to the figure provided in Question 4.

- a) Food waste collected by local authority b) Industrial food waste c) Commercial food waste d) Energy crops (e.g. maize, miscanthus, short rotation coppice, etc.) e) Sewage f) Wet manure (cattle/pigs) g) Chicken litter (broiler and layers) h) Dry manure i) Other (please specify) j) Don’t know
- i) Please indicate the total volume (tonnes of dry matter equivalent or %s) (Open End) ii) Don't know iii) Prefer not to say iv) Not Applicable

Feedstock (geographic origin)

We would like to understand the geographic distribution of the feedstock used in this plant in the financial year 2022-2023. What proportion of feedstock was generated onsite and what proportion was sourced externally?

- a) Onsite b) Within 5 miles c) 5-9 miles d) 10-19 miles e) 20-29 miles f) 30-39 miles g) 40-49 miles h) 50+ miles
- i) Please indicate the total volume (tonnes of dry matter equivalent or %) (Open End) ii) Don't know iii) Prefer not to say

Feedstock (capacity)

Taking into consideration planning, regulatory and physical constraints; what was the maximum working input capacity of this plant in the financial year 2022-2023? This is how much feedstock you could process rather than what you actually process.

- a) Please indicate the total volume (tonnes of dry matter equivalent) (Open End) b) Don't know c) Prefer not to say

Energy output (capacity)

What was the maximum biomethane generation capacity of this plant in the financial year 2022-2023? This is how much biomethane you could generate rather than what you actually generate.

- a) Please indicate the total volume (MWh) (Open End) b) Don't know c) Prefer not to say

Digestate output (volume)

What was the quantity of digestate produced in this plant in the financial year 2022-2023?

- a) Please indicate the amount of digestate in wet weight tonnes (Open End) b) Don't know c) Prefer not to say

Digestate storage and management

Was the digestate you produced in 2022-23 separated?

- a) Yes b) No c) Don't know d) Prefer not to say

Digestate storage and management

Was the digestate you produced in 2022-23 stored in open or closed storage?

- a) Open b) Closed c) Don't know d) Prefer not to say

Digestate storage and management

Was the digestate you produced in 2022-23 PAS110 digestate or non-PAS110?

- a) PAS 110 digestate b) Non-PAS 110 digestate c) Don't know d) Prefer not to say

Digestate output (proportion of this replacing traditional fertilisers)

How much of the digestate that this plant produced went to each of the following destinations in the financial year 2022-2023? Please enter the value zero ("0") if your plant did not send any digestate to a particular destination.

- a) Sold to users off-site b) Provided free of charge to users off-site c) Site operator paid user to remove d) Used by your own business e) Disposal to landfill f) Disposal to sewers g) Other (please specify)

- i) Please indicate the amount of digestate produced (tonnes or %) (Open End) ii) Don't know iii) Prefer not to say iv) Not Applicable

Digestate output (proportion of this replacing traditional fertilisers)

(Ask if 13d > 0) Of the digestate that was used (i.e. not disposed of to landfill or sewers), where was it applied in the financial year 2022-2023? Please enter zero ("0") if digestate was not applied to a particular use.

- a) Agriculture b) Field grown horticulture c) Landscape development d) Landfill restoration e) Fuel for energy recovery f) Other (please specify)
- i) Please indicate the amount of digestate used (tonnes or %) (Open End) ii) Don't know iii) Prefer not to say iv) Not Applicable

Costs (operating costs)

Please indicate the total operating costs incurred by the plant in the financial year 2022-2023. (£s) (Single Response)

- a) Please indicate the amount in £s (Open End) b) Don't know c) Prefer not to say

Costs (gate fees)

In this next question we would like to ask you how much was paid for the feedstocks you used in this AD/biomethane plant in the financial year 2022-2023. As a reminder, we will only report total numbers provided by all survey participants. Data provided will be kept confidential and only known to the research team and the analysis team of the Department. Your data will not be disclosed wider than this e.g. to the Department's policy-staff. Please indicate how much was paid for each of the following feedstocks that were used in your plant in the financial year 2022-2023? If you don't know the cost, please select 'don't know'. If you charged a fee for the feedstock, enter '-' followed by the amount.

- a) Food waste collected by local authority b) Industrial food waste c) Commercial food waste d) Energy crops (e.g. maize, miscanthus, short rotation coppice, etc.) e) Sewage f) Wet manure (cattle/pigs) g) Chicken litter (broiler and layers) h) Other (please specify)
- i) Including transport (in £s/tonne) ii) Excluding transport (in £s/tonne) iii) Don't Know iv) Prefer not to say v) Not Applicable

Leveraged finance

What was the total amount of leveraged finance obtained for this plant (in £s)? Please indicate the amount of debt or borrowed funds utilised to finance this plant.

- i) Please indicate the amount of leveraged finance obtained (in £s) (Open End) ii) Don't know iii) Prefer not to say iv) Not Applicable

Revenue (revenue streams – other)

(Ask if Q16a>0 OR Q16b>0 OR Q16c>0 OR Q16d>0 OR Q16e>0) Were you getting paid for your digestate in the financial year 2022-2023?

- a) Yes b) No c) Don't know d) Prefer not to say
- i) Please indicate the average sale price (in £s per tonne) (open end) ii) Select the relevant option from the dropdown list (£ per tonne for the product only / £ per tonne for the product and transport /£ per tonne for the product, transport and application) (Single Choice) iii) Don't know iv) Prefer not to say v) Not Applicable

RTFO certificates

Were you producing biomethane certified to RTFO in the financial year 2022-2023?

- a) Yes b) No c) Don't know d) Prefer not to say

RTFO certificates

(Ask if Q19 = a) Did the certification apply to all or part of your output in the financial year 2022-2023?

- a) All b) Part - how much? (in m3 / MWh) (Open End) c) Don't know d) Prefer not to say e) Not applicable

Carbon capture

Was this plant capturing CO2 during the financial year 2022-2023?

- a) Yes - can you specify what was done with the captured CO2? (Open End) b) No c) Don't know

Methane leakage

Did this plant have equipment onsite to detect methane leakage during the financial year 2022-2023?

- a) Yes b) No c) Don't know d) Not applicable

Ammonia mitigations in place

Did you have anything in place to mitigate ammonia emissions from your process, storage or spreading in the financial year 2022-2023? This may include covering slurry and digestate stores or lagoons with a custom fitted sheet.

- a) Yes - can you specify the measures you had in place to reduce ammonia emissions from your process? (Open End) b) Yes - can you specify the measures you had in place to reduce ammonia emissions from digestate storage? (Open End) c) Yes - can you specify the measures you had in place to reduce ammonia emissions from digestate spreading? (Open End) d) No - why not? (please specify) (Open End) e) Don't know f) Prefer not to say g) Not applicable

RGGO

Was your plant RGGO certified in the financial year 2022-2023? RGGO stands for Renewable Gas Guarantees of Origin, which represents a certification for the production of renewable gas.

- a) Yes b) No c) Don't know d) Not applicable

GGSS admin costs

Please indicate how much time your organisation has spent in completing the following administrative duties because of its participation in the Green Gas Support Scheme (GGSS) in the financial year 2022-2023. (hours per year) (Grid question). Please select not applicable if a particular duty is not relevant to you.

- a) Keeping up to date with obligation requirements b) Correctly calculating, checking and presenting figures c) Gathering and assessing figures and information d) Keeping records throughout the year e) Submitting information to Ofgem f) Providing meter readings quarterly
- i) Please indicate the amount of time in days (assume a 7.5-hour day) ii) Don't know iii) Prefer not to say iv) Not Applicable

HMG policies

Has this plant participated in any of the following HMG policies in the financial year 2022-2023? Please select all that apply (Multiple Response)

- a) Renewable Heat Incentive (RHI) b) Renewables Obligation (RO) c) Contracts for difference scheme (CfD) d) Feed in Tariff (FIT) e) Renewable Transport Fuel Obligation (RTFO) f) Other g) Don't know h) Prefer not to say

HMG policies

If you wish to make any final comments to the Department about how government policies have affected the plant(s), please do so here. (Open End)

- a) Please type your answer in the box below (Open End) b) Don't know c) Prefer not to say

Annex 5: Qualitative Thematic Analysis

The Design of the GGSS

Budget Management

Although there were mixed views on the budget management mechanisms that are part of the scheme, there was no evidence in the interviews that the budget management mechanisms were a factor in applicants deciding to, or not, apply to the scheme. Some feedback was very positive regarding the configurations of budget management mechanisms:

> *"[the budget management mechanisms] wasn't the deciding factor in not to go for it."* – GGSS applicant

> *"I think I think the checks and balances in terms of managing the budget are better now in the GGSS than they have ever been."* – Non-applicant

Two respondents queried the necessity of the budget management mechanisms, citing the fact that this has the potential to cap the number of plants that get built as part of the scheme if demand outstrips the budget available, and the fact that the GGSS is levy, rather than taxpayer, funded, meaning protections against large tax liabilities are less necessary.

Two respondents highlighted the transparent nature of the scheme implementation as a point to praise, particularly as it helps applicants stay on top of any potential budget management issues (i.e. foresight if a degression is likely) minimising the risk of budget management to applicants.

> *"[Ofgem] publish the data of how many applications there's been there every week, which is useful so you can […] see if a degression is coming"* – GGSS applicant

> *"There's less risk now, isn't there? Because […] we don't think they're going to fill the budget, so the likelihood of degression pretty limited."* – GGSS applicant

> *"I think the transparency is good. You know, these quarterly updates come out [and] it's quite clear how many applications have gone in, how many are at stage two, how many reach stage three"* – GGSS applicant

> *"Now that they kind of published the data of how many applications there's been there every week, which is useful. So, you can kind of see if a degression is coming."* – GGSS applicant

Timing

A critique of the scheme, identified by five respondents was the limited timing before scheme closure, suggesting that the current GGSS end date of the scheme was too tight for all projects to be fully realised. The point made by two respondents was that, given the length of time to

build and commission plants, the scheme closure date in reality is not in November 2025, but significantly sooner than this.

> *"The one outstanding critique – a very high level one but important – is the time constraints. So, we only have until 2026 to actually realise projects under that scheme and that is not enough time."* – *GGSS applicant*

> *"The effective scheme closure day is really about six months from now"* – GGSS applicant

The risk highlighted by non-applicants is that the scheme will miss out on supporting new plants that plan to come online, but for a variety of factors (as referenced in previous sections), have not been able to do so yet.

> *"Timing might not work to use the GGSS as will be looking at investment in 2025"* – Non-applicant

> *"There's probably quite a few projects in development ready to be constructed off the back of the food waste policy. Aren't they all trying to come on-line really, really quickly before the scheme ends in 2025? A reasonable size AD plant, it's going to take you ten months to build and commission. You're under two years away from the end of the scheme so I think that's kind of put a significant pressure on the system."* – Non-applicant

One Ofgem respondent suggested that the time that may be required to get a large-scale AD plant up and running compared to the length of time that the scheme is open for[5] was a mismatch in the design of the programme.

> *"The duration of the scheme compared to the time it takes to develop a biomethane project could be a challenge. If the scheme is only open for five years, but it takes ten years to get a large-scale project off the ground, it can create difficulties."* – Ofgem respondent

Comparison to the Non-Domestic RHI

A common theme emerging from interviews was comparing the GGSS to the ND RHI scheme. For the vast majority of respondents (eight of ten respondents), there was consensus that the GGSS was effectively a continuation of the ND RHI, with some additional nuances and improvements.

> *"It did feel like the same machine with a different label" – GGSS applicant*

A majority (four out of five) of GGSS applicants[6] respondents highlighted that the GGSS had learned the lessons from ND RHI to improve the scheme, both in terms of design and delivery.

[5] At the time of the comment, the scheme had not yet been extended
[6] Two non-applicants familiar with the GGSS also agreed that the GGSS scheme had improved on the RHI scheme.

Examples of learning applied to GGSS included improved flexibility, improved processes to apply, and improved communications with Ofgem.

> *"This scheme builds on all the lessons learned from that period to make sure that this one really is doing the job."* – GGSS applicant

Two GGSS applicants highlighted that some elements from the ND RHI scheme had been *"grandfathered"* into the GGSS where it was *"not logical to continue with".* Examples of challenges provided by respondents included accounting for heat in reporting and tariff tiering which limited plant size. It was suggested by one applicant that the Department could review the materials and requirements, to identify any elements that may be carried through unnecessarily from the ND RHI scheme.

> *"There was no intellectual basis to follow what happened on the (ND) RHI other than that's what happened before."* – GGSS applicant

Support Scheme Rationale

Five respondents reiterated the necessity of the scheme to enable the economics of their plant to work, and without it, additional biomethane would not be generated. One applicant explained that investors are looking for a minimum return for them, without any debt involved, and this scheme is the thing that enables this to be realised.

> *"(ND) RHI clearly came to an end and therefore the role of the [Green Gas] Support Scheme was extremely important and quite frankly, without the support scheme today, from our perspective, our operating model wouldn't be viable economically."* – GGSS applicant

> *"It [the GGSS] was required for the project to go ahead […] It was one of the main pieces that the funders look for to be in place"* – GGSS applicant

Two respondents discussed the current high wholesale gas price context acknowledging the favourable returns from high wholesale prices but cautioning that given the short-term nature of these fluctuations, that they didn't impact significantly on their decision making.

> *"It's not just about now, it's we're doing a fifteen-to-twenty-year project, so by the time it takes two to three plus years to build out an AD plant that would really change our view looking at the gas prices today."* – Non-applicant

The Implementation of the GGSS

The Application Process

General comments from the majority (4 out of 5) of applicants on their experience of the application process were all positive, commending the logic, clarity, and straightforwardness of the process. (The other applicant respondent relied on external consultancy support to complete their application as it was felt to be too technical.) One applicant commented:

> *"The application is very transparent, very clear, very user friendly"* – GGSS applicant

Although all of the respondents who had experience of both ND RHI and GGSS applications (four respondents) found the processes to be broadly similar, there was indication from a number of respondents that the GGSS application process was an improvement.

> *"[the process was] not too dissimilar to the (ND) RHI tariff guarantee scheme"* – GGSS applicant

On the actual processes of submitting information to apply, one ND RHI participant commented that their experience of applying to the ND RHI using the online portal was *"incredibly clunky".* By comparison, a majority of the GGSS applicant interviewees responded positively about the application portal, identifying specific challenges they encountered, rather than a wholly negative experience of the technology. Specific frustrations included the inability to go back to add information to a previous section and the need to restart the process if one accidentally clicks submit, challenges with the number of documents one could upload, the occasional duplication of asks within the system, and the inability to access the portal outside of the UK.

> *"The GGSS lessons have been learned from the (ND) RHI, which is great. The practical systems in terms of making submissions and applications and stuff have definitely improved for sure."* – GGSS applicant

One criticism of the ND RHI process was the need to use consultants to complete applications, which was described as a *'cost burden for [the respondent] that is increasing over time".* In comparison with the ND RHI, caveated by the fact that sample sizes were small, only one GGSS applicants reported using consultants to help with their application.

In terms of the data required, the majority (four out of five applicants) felt that the requirements were proportionate and as per expectations. One difficulty in the data requirements, raised by one applicant, was the need to provide quotes for equipment, evidence of feedstock contracts and Gas Purchasing Agreements with gas suppliers, where commissioning dates were long into the future. Although not currently an issue, as this respondent considers future applications, they sense this requirement will be difficult to meet and does not fit with the *'natural'* project development.

Additionally, one respondent highlighted the challenge of '*chicken or egg'* in evidencing financial close where investors were looking for confirmation of GGSS Tariff Guarantee and the Phase 2 requirements sought evidence of investment. A similar situation was also described in relation to the requirement to evidence a network connection as part of the application, which may cost £50,000, with no guarantee that the support will work out.

Eligibility Criteria

A majority (four out of five) of GGSS applicant respondents had a positive view of the scheme application requirements, both in terms of eligibility and sustainability, commenting that there

was *"no surprises"* and that requirements matched the level of support available on the scheme.

> *"There's nothing on the scheme that would stop you from entering. I think market factors are going to play a bigger role than eligibility onto this scheme. Generally, I think it's quite fair."* – GGSS applicant

One GGSS applicant went further to encourage the bar for applications to be set as high as necessary to ensure that only deliverable projects progress through the application process, to avoid a scenario where GGSS budgets are committed but post-scheme closure, are not consumed.

> *"I think Ofgem should be as robust as they possibly can around that point to say that this isn't a speculative like project. You know, there has to be some real substance otherwise we're going to end up with [the scenario] where the [GGSS] 'pot' gets consumed but three years down the line, once the scheme [has] closed, the funds haven't been consumed"* – GGSS applicant

Across all applicant/non-applicant respondents, only one challenged the requirement of a minimum of 50% waste feedstocks, in and of itself, and in two cases, respondents suggested that the requirements could have gone further to an even greater proportion of mandated waste feedstock, given the circular economy co-benefits[7]. Two respondents highlighted the significance of the co-benefits of biomethane generation from waste as offering better food waste disposal and as encouraging better farming practices, with the former suggesting that the waste management benefits were potentially more significant than the green gas injection.

> *"Generally, the market is asking for more waste generated feed and so I don't think [DESNZ] is behind the curve but [they] have set a good target."* – GGSS applicant

> *"I think we could make [the non-waste feedstock proportion] 20-30%, which is really sort of going right throughout Europe anyway."* – GGSS applicant

Although among the non-applicant respondent group there were a number of reasons cited for their non-application (and in some cases, applications from this cohort were planned in the future). A key issue identified by three of the non-applicants was the inability to register existing plants onto the GGSS.

> *"The Green Gas Support Scheme wasn't open or eligible for existing plants, so we were aware of it, but, you know, we knew it wasn't an option for us."* – Non-applicant

> *"It's simply that the eligibility criteria for the new scheme doesn't support the way the business is currently operating."* – Non-applicant

[7] Five respondents specifically said they had no issue with the 50% threshold, and the other four, when asked on any issues with the eligibility requirements, did not chose to challenge the waste feedstock requirements. One respondent that did identify this as an issue suggested that the 50% threshold would artificially increase competition for waste feedstock and increase costs for that respondent to continue to source waste in the market.

Respondents were aware of the objectives of the scheme to drive new AD plants but highlighted that this may limit the potential pipeline of plants that could apply, by excluding existing plants that may otherwise decommission.

> *"Currently it's trying to drive investment in new assets – that seems to be the main aim of it…. the GGSS is for new assets and the (ND) RHI was for existing assets."* – Non-applicant

> *"I've got two plants that have been running for twenty years and they are now at the end of their ROC [Renewables Obligation Certificates] subsidy. And I don't want to shut them down. They've got a gas pipe close by. I want to keep [these AD plants] going but [which would require] the Green Gas Support Scheme. […] There are thirty plants in the UK that are, like me, they've got a feed in tariff or a ROC. They also have gas capacity nearby and they could switch."* – Non-applicant

Two respondents discussed approaches that they might consider taking (although in each instance, this was hypothetical only) in order to make their project work within the GGSS requirements. These included removing and rebuilding an existing plant, as well as building two plants side-by-side. Although for some, this was seen as an appropriate way to meet eligibility rules and maximise returns. One respondent did suggest that these approaches needed better control and another respondent recommended that better clarity on what could be done within the existing rules and what was not allowed could be better communicated.

One respondent raised a further concern that the strict eligibility requirements limited the potential for innovative and cost-saving solutions.

> *"Some plants with innovative solutions may find themselves ineligible due to restrictions on equipment sharing or reuse. […] The strict guidelines prevent the use of injection hubs or shared equipment. We have had discussions with applicants proposing alternative solutions, but we must adhere to the rules, which may hinder innovation to some extent.* – Ofgem respondent

Planning Permission

Two non-applicants highlighted planning permissions as a factor in delaying or deterring applications to the GGSS. For one non-applicant, although involved in multiple AD plants under other schemes, they have decided not to progress any new plants given the difficulties in getting planning permission and building them. Another non-applicant, who was preparing an application at the time of interview, highlighted that they expected a 16-week decision period to get planning permission post submission, before they could progress an application.

Communication with Ofgem

Three respondents (both with experience of the ND RHI scheme) highlighted some difficulties in communicating with scheme administrators at Ofgem on the ND RHI scheme. Common issues included difficulties in speaking to the appropriate individual, lack of individual contact point, time taken to receive email responses, and frequent questions. In contrast,

communication with Ofgem on the GGSS was viewed positively, specifically mentioned by three out of five applicants, citing this as an improvement from the previous scheme.

> *"I find [the Ofgem team] and the scheme is definitely far more accessible [than ND RHI] for somebody like ourselves as a developer." – GGSS applicant*

Three GGSS applicants specifically referenced the fact that for the GGSS scheme, they had one named point of contact to direct questions to and who could support them through their application process. The benefits of not needing to go through a central system to find the appropriately skilled individual within Ofgem to speak to was significant in smoothing the process and minimising delays in application.

> *"We had the one point of contact [that we] , could e-mail him and get a phone call within a day if we needed to." – GGSS applicant*

> *"As soon as we had that question, he was on the phone, and he just explained it and it, so it was absolutely fine."* – GGSS applicant

Three respondents also highlighted that communication on the phone rather than over email had made, or would make, the process of applying much more straightforward. Respondents highlighted that conversations over email could often fall into frequent *"back and forth"* emails and taking the time for a phone call to walk through problems together in real time would speed up the process overall.

> *"We get regular phone calls, which is always helpful… Historically when I tried to phone the Ofgem [ND] RHI team, I would end up on hold for about four hours and then you know if I was lucky enough to speak to somebody, I'd probably be diverted or told to send an e-mail to a generic e-mail box and then be told that there's another 15 days, 10 days waiting time. It was just it was very, very difficult."* – GGSS applicant

One applicant specifically highlighted the inefficiencies with emailing versus phone calls as a key factor in delaying their progression on the GGSS.

> *"It's pretty hard to reach them […] there's no telephone you can call. It's like all emailing to the central e-mail address […] but that also means that if I'm busy with the submission and it's not working, I have to e-mail and wait four days to hear from someone." […] "I'm not saying that Ofgem wasn't responsive. I'm saying they were inefficient in actually helping." – GGSS applicant*

Respondent perception of the improved communication with Ofgem was identified as a consequence of Ofgem being more *"front-footed"* and proactive in supporting applicants through the GGSS process.

> *"[Ofgem] were proactively getting in touch with me […] whereas with [ND] RHI it was very much the other way round that. You'd wait in a queue and then you'd get through to someone who wasn't the right person."* – GGSS applicant

> *"I think the team at Ofgem have been far more proactive and so they've been reaching out."* – GGSS applicant

> *"What I think has been particularly helpful has been the proactiveness of the team"* – GGSS applicant

Whereas with ND RHI, there was an impression among two respondents that the ND RHI team didn't fully know or effectively communicate what was required of applicants and respondents, with GGSS, respondents felt that the opposite was true.

> *"[Ofgem] know what they're talking about and are very quick to diagnose what's needed and not needed."* – GGSS applicant

Two applicants explained that the guidance documents produced by Ofgem were clear and helpful, though slightly less specific to particular project contexts than might be desired. Respondents more frequently referred the personal guidance provided by communicating with individual Ofgem contacts.

Two applicants also pointed out that, in their opinion and from their perspective, the approach taken by Ofgem to draw a hard line on submission deadlines, whilst understandable from Ofgem's perspective to drive forward applications, was perceived to be non-collaborative, and not in keeping with potential real-world delays outside of the applicant's control. This was particularly challenging when applicants were sometimes left unsure of Ofgem's timelines for returning feedback themselves[8].

> *"It's quite a hard line at the end of the e-mail if you said you know, "provide XYZ by the next week or all of this is down the toilet."* – GGSS applicant

For one non-applicant, they felt that eligibility rules, and in particular the ineligibility of existing plants for the GGSS, had not been fully communicated:

> *"It wasn't clear leading up to it, that they were going to work the policy like that. So that came as a bit of a surprise." – Non-applicant*

Incentive Level and Deployment

Although deployment onto the scheme has been slower than anticipated, the consensus from Department and Ofgem is that the issue is with external supply chain and feedstock challenges, rather than the level of incentive. One Department stakeholder stated:

> *"We expected a lot more to come on in the first year to the scheme. When the scheme was designed, we worked with DEFRA to think about their upcoming policies on food waste collection. […] Because that hasn't moved forward, a lot of developers that we*

[8] It is important to note that the deadlines enforced by Ofgem are set in the Regulations from the Department, and hence Ofgem is unable to apply leeway. A potential lesson to be taken from this is better communication between projects and Ofgem on why the hard deadlines are in place.

> *thought would use that obviously didn't have that security in place to kind of come forward. […] Also timing because of economy; this led to supply chain issues. […] So [the Department is] pretty confident it's these reasons, rather than scheme design or amount of money we're offering."* – Department for Energy Security and Net Zero

Six respondents had a positive impression of the current tier one tariff levels, citing that the current tier one was enough to make plants *"viable"* and that the economics of the plant were *"predictable"* over the full GGSS period. For those with experience of the ND RHI scheme, the increase in volumes available in the first tier was an improvement from the ND RHI scheme. One applicant highlighted that investors looked for a return of between 8% and 10%, and that current tariff tiers were enough to enable this.

> *"I think the levels are about enough to make things viable."* – GGSS applicant

> *"We don't feel that [the incentives are] not fair."* – GGSS applicant

> *"I think the change that they made was that they increased tier one from 40 to 60 [GWh], which was welcome without a shadow of a doubt."* – GGSS applicant

In contrast, respondents were clear that tiers two and three posed more a challenge for commercial viability.

> *"I don't think tier three works commercially, or tier two really for that matter. You need projects in tier one for it to work commercially."* – Non-applicant

> *"If you're producing gas in tier three, it's not going to be that viable, to be honest"* – GGSS applicant

The consequence of the current tier rates results in reduced levels of incentive for tiers two and three and given what works economically with the tier tariffs, determines the market optimum AD plant size.

> *"So [the Department] obviously decided what's the kind of optimum size of plant? Based on the first tier, which you know could be a bit bigger. Suppose if they want to encourage big plants or not"* – GGSS applicant

> *"This scheme was designed for a kind of standard food waste size plant and that kind of 60 to 80 [GWh output]"* – GGSS applicant

This has meant that bigger plants are more likely to come through, than on the ND RHI scheme, but again three respondents queried whether the tariff tiers could have been increased even further to enable the largest plants to be built to drive production of Biomethane that is required to meet UK need.

> *"Instead of 40 MW hour projects now looking at the 100 MW hour projects as being more commercially sensible."* – Non-applicant

> *"You're never going to get enough bio-methane produced in the UK through tier one and tier two to meet the UK's need"* – Non-applicant

> *"Denmark are 45 or 50% on their way to substituting their fossil gas need […] the biggest reason why it works is because things are done at scale, and at the moment I would say the weakness of the Green Gas Support Scheme and its predecessor, the [ND] RHI, is that that tier three gas isn't well enough supported."* – Non-applicant

> *"If we get to the end of the GGSS and the whole budget has been fully taken, well that's okay, it worked. But if you're going to get to the end of the GGSS and its only half consumed, the only thing you can be left with looking at is to say well clearly the incentive wasn't high enough to make it economically viable for people to go out and build plants." – GGSS applicant*

A key benefit of the GGSS, raised explicitly by two respondents[9], was its flexibility compared to ND RHI. Four individuals explained that other revenue streams from Biomethane (e.g. RTFO, GGCS) were critical in helping the plant economics *"stack up".*

> *"With the GGSS, [when comparing to ND RHI, transitioning between different market tariffs was] a lot [quicker]. So, for instance, RTFO can sit on top of this or alongside it, and you can swap and change which one you think is more valuable at a quicker pace. It was that flexibility that I think was exciting to the investors."* – GGSS applicant

> *"The fact that the price for the green gas certificates has improved substantially. In combination with the GGSS, the economics really stack up."* – GGSS applicant

Plant Size

Four respondents articulated the point that the level of subsidy available will be the key determinant in the size of plant that gets commissioned. The view of applicant respondents was that in designing the tariff tiers at their given levels, the Department have *"decided what is the […] optimum size of plant, based on the first tier"* and that the GGSS was optimised for the *"standard food waste plant [… of] sixty to eighty [GWh of output].* One respondent highlighted that this point is illustrated through the counterfactual that, for plants under the ND RHI scheme, prior to the tariff arrangements coming into force, many of these are producing output of a greater range than the sixty-to-eighty optimum plant size on the GGSS.

Three respondents praised the GGSS for improving (from the ND RHI scheme tariff tiers) on the size of plants that can economically be built, given the increase in the tier one tariff limits. This has had a material influence on the size of plants deployed of the GGSS.

> *"I mean it would have been achievable on the [ND] RHI, but we would have been planning to build a smaller plant. Now we're on the Green Gas Scheme, it's a bigger one."* – GGSS applicant

[9] General positive sentiments towards the flexibility on the scheme was shared by seven respondents.

Two respondents (applicants and non-applicants) emphasised the lack of support or encouragement for plants at a larger scale was a drawback of the government's biomethane policy, suggesting that in order to meet UK targets, increased scale was a necessity.

> *"I would probably then challenge that perhaps 60 [GWh] was still not far enough if […] the ultimate game here is to encourage as much biomethane generation."* – GGSS applicant

> *"We're never going to hit [UK government] targets both in 100 GWh plants, we need to be building 500 GWh plants like ours, run, professionally"* – Non-applicant

This is complicated by the fact that one further respondent felt that lack of locally available feedstock available and opposition to transporting large amounts of feedstock to a central location, meant that plants were constrained in achieving scale by the local area.

> *"You want to only go to a certain size to be able to make it economically viable because biogas for me ties into the local economy. It's got to tie in with that what's available within your 20 - 30 maximum miles radius around your plant."* – GGSS applicant

> *"To do it all on food waste is hard. You could maybe build one of them for London or Manchester or Birmingham or something if you were getting exclusivity to all the food waste."* – Non-applicant

There was also evidence of plant size being determined by the flexibility of the RTFO scheme. Two respondents talked about intentionally *"oversizing"* their plant capacity, based on GGSS tariff constraints, with the intention of supplementing with specifically the RTFO scheme.

> *"It doesn't necessarily mean that you're oversizing the plant with the intention of producing 100 [GWh] worth of GGSS [biomethane]. […] You may be oversizing it with the opportunity of knowing that maybe you'll do 60 [GWh] of GGSS and you put 40 [GWh] into a road transport fuel scheme."* – GGSS applicant

External Context

Feedstocks

Some stakeholders from Ofgem and the Department had the view that feedstock availability was a key barrier to deployment on the GGSS, and specifically highlighted challenges with food waste feedstock. These stakeholders referenced the delays to DEFRA's mandatory food waste collection programme as not giving the confidence to the market of feedstock availability at a viable price.

> *"Accessing feedstocks has also presented challenges. Contracts for feedstock supply need to be in place, but there have been delays on DEFRA's side regarding food waste collection by local authorities. Once this issue is resolved, it is anticipated that there will be an increase in available feedstock."* – Ofgem respondent

> *"Obviously if you have policies in place that you're collecting food waste more consistently – that would provide more stable, consistent feedstock that an AD could use. We expected that policy to have moved a bit quicker on DEFRA's side to align with the scheme. It was quite a symbiotic thing, where DEFRA would collect more food waste, and we'd use that."* – Ofgem respondent

> *"There's [the] municipal food waste policy would increase the supply of food waste for these plants. There has been a bit of uncertainty around it externally and that's we think that's might have had an impact on some developer's confidence in bringing projects forwards."* – Department for Energy Security and Net Zero Stakeholder

Similarly, the key challenge that a number of applicant and non-applicant respondents highlighted was the competition for feedstocks that will impact on plant viability. The competition for waste feedstock has changed the economics of plants such that, as one respondent explained, what once was a gate fee four or five years ago now comes at a price.

> *"You don't get a gate fee anymore for food waste, and many of the early food waste plants are now having to pay for it and they're very fortunate that they're still on the higher subsidies, if they were on today's subsidies through the GGSS it probably wouldn't work."* – Non-applicant

Two non-applicants highlighted that the limited food waste feedstock in the market was limiting their ambitions and ability to progress AD plants on the GGSS, specifically citing delays in the Environment Act that would provide a significantly increased supply of food waste. One respondent highlighted the fact that mandated separate food waste collection is not likely to occur before 2025 which didn't give them the *"confidence to build a new AD plant under the GGSS".*

> *"You need food waste to make a food waste plant work and the food waste is not in the market currently, therefore we haven't progressed any new build facilities"* – Non-applicant

> *"We kind of need the food waste to be there. Once the food waste is there, we then need the financials to stack up to justify the investment"* – Non-applicant

Supply Chain / Economy

Respondents have identified supply chain challenges and inflation as key aspects of the external context which have impacted on their decision making and ability to progress applications. A majority (two out of three[10]) of the respondents currently in the application and registration process highlighted the difficulties in commissioning their respective plants as a result of the supply chain challenges, putting pressure on both their commissioning dates.

[10] Other applicant respondents either had unsuccessful applications or had already registered on the scheme.

> *"In terms of getting everything you need a lot of the plant and machinery has been delayed."* – GGSS applicant

> *"[Delays in the supply chain] was a practical challenge that we faced and the reason why we pushed [back] our application"* – GGSS applicant

One respondent specifically highlighted a micro-chip component which, although not expensive, was critical to commissioning, and had roughly a twelve-month lead time and also gave the example of the 'Grid Entry Unit' component which during the ND RHI scheme had four UK suppliers and now, there is only one supplier, leading to inherent supply chain risk.

Similarly, current GGSS applicants have highlighted inflation and cost-increases as a key challenge to progressing plants, with this context changing significantly for both, the costs from initial project planning to actual delivery and the economics of the plant they were progressing. One of those suggested cost increases could be close to double the initially scoped costs.

This view was reflected by some stakeholders from Ofgem and the Department, who highted wider factors such as the war in Ukraine (and resultant interruption of Gas Supply) and Covid-19 pandemic (and resultant supply chain interruptions) as critical reasons for the longer than anticipated deployment time.

> *"There are eleven other [AD plants] with tariff guarantees or in the process. Some of them have had to drop out and reapply with later commissioning dates. Often, this is due to difficulties in ordering equipment, which is often bespoke and needs to be imported from countries like Denmark, Austria, Germany, Russia, and Ukraine. The gas supply disruptions in those countries have led to delays and cancellations of equipment shipments, with no viable replacements available. These delays have forced applicants to adjust their timelines and potentially face challenges in meeting the scheme closure date."* – Ofgem respondent

> *"Supply chain issues that means that it's taken longer to build plants than was expected by anyone. [this is consequence of the] pandemic and supply chains [disruptions], generally [and difficulties with] labour markets and trade staff."* – Department for Energy Security and Net Zero Stakeholder

Other Supportive Policies

As highlighted previously, seven respondents saw the flexibility that the GGSS enabled as a significant benefit of the programme, helping make the economics of plants work for the current market, providing confidence and security.

> "*The whole package, the GGSS, the green gas certificates, the wholesale price of gas … makes it very attractive (…) And then you also have the use of transportation RTFO. Compared to the rest of Europe, this makes this scheme very unique and absolutely I think fantastic. We can buy into the transportation sector or into the heating sector depending on what the economics are."* – GGSS applicant

The RTFO was seen by five respondents as an increasingly important part of their revenue stack[11]. However, many have cautioned that it does not currently provide the same security and consistency of schemes such as the GGSS. It is viewed by most as an *"added bonus"* or *"optimisation strategy".*

> *"But I know that they [the investors] have spoken about the RTFO and they're looking at it, so all of that wider support is helpful."* – GGSS applicant

> *"It's the ability to access the RTFO that really makes the commercials stack-up."* – Non-applicant

> *"It's less bankable than the GGSS. So, the way we view it is almost once we're up and running, it's something that will consider you know as optimization strategy potentially, but the GGSS is like our base case."* – GGSS applicant

> *"[Our investors] will not invest in a plant that has effectively the risk exposure to price fluctuations of a ticket system that can collapse at any point in time."* – GGSS applicant

One respondent however suggested that the RTFO opportunity was where the *"real value"* of biomethane is. This respondent suggested that the greater opportunities for scale with the RTFO would lead to cost increases as plants compete for feedstock, suggesting that the current model of plant will likely struggle to continue moving forward.

> *"The tier one and tier two gas is going to go into the RTFO as well because that's our target market. That's our primary mark. The real value is with the RTFO."* – Non-applicant

Three plants (including both GGSS and ND RHI plants) also highlighted the growing significance of the Green Gas Certificate Scheme, enabling the transfer of Renewable Gas Guarantees of Origin (RGGO), as a revenue stream for plants. One respondent explained that these have, in the past five years, become more 'bankable' with funders.

> *"They were used to be kind of a small bonus, but they've become much more significant part of the revenue stack" – GGSS applicant*

Another respondent did highlight that there were some challenges in registering RGGOs, suggesting that the process would be easier if there was more coordination between the GGCS and Ofgem.

Although a short-term financial benefit, one further applicant suggested that in time their organisation would move to claim these certificates themselves in order to meet their own Net Zero organisational objectives.

[11] Two additional respondents had a moderate view that flexibility to claim under the RTFO welcome, but not particularly significant for their model.

Design of the Green Gas Levy

Successes

Both Ofgem and Department for Energy Security and Net Zero respondents expressed positive sentiments toward how the Green Gas Levy had been designed. Although some stakeholders did highlight minor areas that posed more of a challenge, the strong consensus was that the levy has so far been a success. Department respondents explained that where Ofgem had the opportunity to suggest changes to the legislation for the levy, those that came forward were minimal. Similarly, on the Ofgem side, those interviewed felt that the proscriptive nature of the legislation to determine their role made the job of delivering the levy more straightforward.

> *"[The levy is] designed well, working well, [and] is a success. [Ofgem] went into it understanding what works and didn't from elsewhere; it was understood by parties and those who run it..."* – Ofgem respondent.

> *"[The Department] haven't been pushed [by Ofgem] to change anything on the legislation side, which is kind of where we come in on how it's delivered. I'm sure there are challenges on how it's delivered, but nothing that has landed on my door.*" – Department for Energy Security and Net Zero stakeholder.

> *"It was designed to be quite sort of easy to deliver and straight forward and the regulations are very directive in that way that there aren't many areas for us to have discretion because we advised DESNZ it would be better if it was very black and white as to what we were supposed to be doing every quarter."* – Ofgem respondent.

Both Ofgem and Department stakeholders saw the key success of the levy as fulfilling its main policy aim, collecting sufficient funds to make payments to biomethane producers on the GGSS. Stakeholders emphasised that the levy has collected the level of funding that it intended to, and although the amount collected exceeds the payments made, this imbalance is not evidence that the levy did not work as intended.

> *"I think so far, what the outcomes have shown is that we have collected enough money so far. In terms of getting it right, we've hit the figure we wanted to collect based on the GGSS budget caps, meaning the levy is working appropriately. So, I guess that was always the main test of whether it has been set up properly.*" – Department for Energy Security and Net Zero stakeholder.

> *"The levy has been very successful. It's collected the right amount of money. There've not been any hitches in terms of doing that. Setting the levy was a smooth process and every part of the mechanism has kind of worked as it was designed to do.*" – Department for Energy Security and Net Zero stakeholder.

> *"We have collected money; we have kept that money. We have made payments out. The money we've collected is much more than the payments were made out, but that's by-the-by. It hasn't failed so therefore it has succeeded so far."* – Ofgem respondent.

The GGL process evaluation probed the level of confidence that some stakeholders from Ofgem and Department had in the levy design to operate as designed. Although a small number of Ofgem participants did highlight that they had some initial concerns on the contingencies if the levy saw a shortfall in what was required to make GGSS payments, in the main, stakeholders were confident in the processes designed and put in place to manage risk.

> *"So that's in terms of making sure we get enough money in to match what participants payments might be for the next year. They've got a team who do some modelling and forecasting on that. They're looking at trying to forecast what the Applications might be and what the participants payments might be for the next year… So generally, I'd say there's probably generally a high level of confidence. You know, there is always scope for something unexpected to happen, but I think personally I've got a high level of confidence."* – Ofgem respondent.

> *"[Confidence in collecting the right amount is] one of our big focuses. There are some policy decisions on how you set the levy. But that is always based on – we want to minimise the impact on bill payers, but we have to collect enough money for biomethane plants for how much biomethane they produce. That's where uncertainty and risk appetite come in. We do quite a lot of risk analysis around the different options. [The Department] try to work out what's a sensible amount of risk to take.*" – Department for Energy Security and Net Zero stakeholder.

> *"[Collecting too much from the levy is] a lot better than there being too little though. So, we do basically everything we can to make sure there's never too little. So, we have head room built in to our spend projections on the GGSS.*" – Department for Energy Security and Net Zero stakeholder.

Challenges

It was acknowledged by both Ofgem and Department respondents that a challenge for the levy has been the fact that it has collected significantly more money than was required. One gas supplier also raised the issue of funding not being spent in an interview for this research.

Although not a specific complaint nor area identified as not working, it was acknowledged by a minority of Department and Ofgem stakeholders that the levy is a complex way of raising funds for biomethane. Department respondents emphasised the complexity of forecasting and levy setting, and Ofgem respondents, the complexity of translating the levy rules into practice.

> *"Overall reflections, it's quite a technical way of how you actually pay for this AD production. [On ND] RHI it was more about how much money do you want to spend and what is value for money. With the levy you have the putting it on the suppliers and bill payer element. A lot more complexity around that. There's a lot of uncertainty. We have to set the budget caps and the levy ahead of time for the following year, so we have to do a fair bit of forecasting on both sides, and especially on the levy, a fair bit of that is on meter points – how many meter points are there going to be for the next year; how many green gas suppliers are there going to be."* – Department for Energy Security stakeholder.

> *"My overall perspective, based on feedback from the team, is that the rules around the levy are very intricate and complex when trying to incorporate them into a system. There are various dependencies to consider, such as interest rates and automatic calculation of interest, as well as the handling of credit cover—whether it's an excess cover or a deposit. These aspects of the levy design present significant challenges when creating a system around them."* – Ofgem respondent.

Green Gas Levy Features

Compliance and Enforcement

The view from Ofgem respondents on compliance was that to date, there have been minimal issues with compliance, involving only a small number of slightly late payments from suppliers, and in all cases, quickly and easily dealt with. One respondent pointed out that at the beginning of schemes of this nature, some non-compliance is expected as levy payers get to grips with the requirement, and therefore the low level of non-compliance is a positive of the levy.

> *"There's been a handful of late payments, but nothing particularly problematic and all sort of dealt with pretty easily with sort of relatively straight forward engagement with them to get the payments to come in."* […] *"I believe in the few instances, and I'm talking really a handful here, in the few instances where that's happened, people have paid within two or three days, and we have said don't worry about [the interest]."* – Ofgem respondent.

> *"[There has] been some non-compliances but [this has] been minor. These are usually at beginning of the scheme; more complicated schemes usually get a lot more non-compliance. [Suppliers] seem to know their obligations pretty well."* – Ofgem respondent.

> *"There have been a few payments that might miss the deadline by a day or two, and that sort of thing, but generally as far as I'm aware, it's been alright."* – Ofgem respondent.

One explanation suggested by an Ofgem respondent was that the relatively low costs of the levy to suppliers means it is unlikely to pose any significant issues or challenges to suppliers, and therefore there is less risk of non-compliance.

> *"Well, so far suppliers have paid on time generally and they provided the credit cover. I guess it's early days in a way in that the payment amount, the levy rate's been relatively low so far and also compared to some other scheme obligations that suppliers have to comply with. […] I think that probably helps and the fact that we're collecting quarterly rather than annually as well."* – Ofgem respondent.

For those that did miss payment deadlines, rather than taking a punitive approach, Ofgem have sought to be collaborative with gas suppliers, and have used dialogue to prompt suppliers

to make payments, rather than use the other measures to enforce compliance. As was commended by gas suppliers, Ofgem have also sought to be proactive in providing reminders before payment deadlines to help mitigate accidental non-compliance and are actively looking at the market to understand if there is a likelihood that suppliers may struggle to pay. Ofgem are proactively engaging ahead of time on this.

> *"So, when a supplier makes a late payment or when a supplier does not make a payment by the deadline that we give them, we have the power to draw down on their credit cover the next working day. So, we can do that. But we're not bound to do that, and what we like to do because we want to keep our relationships with the suppliers as a constructive working relationship – we don't want to be seen to be overly punitive or coming down too harshly on them. We give them a chance, basically. So, we'll contact them that next working day and tell them we can draw down your credit cover and we will do if you don't make a payment shortly; there is a mechanism in the regulations which applies interest to that payment."* […] *"What we do is we contact [suppliers] and say, 'look, we have not received your payment, what is the issue? Can we help? And you're getting interest charged, so get on it.' Basically, it's a sort of friendly one but also let's give you the facts here, you're racking up a bill…"* – Ofgem respondent.
>
> *"[It's] pretty, straightforwardly in terms of just […] giving the supply that nudge and then they send it."* – Ofgem respondent.
>
> *"I believe there are measures we can take to monitor the relationship with suppliers. We run other schemes, so if there's a supplier struggling to pay on one scheme, it's likely they'll struggle to pay on others as well. We can then assess where our scheme stands in the timeline and ensure proactive communication with them, taking necessary steps."* – Ofgem respondent.

Requiring suppliers to lodge credit cover ahead of time is viewed as an important first layer to ensure GGL funds are collected within a reasonable timeframe and without need for burdensome mutualisation exercises.

> *"Well, I suppose that provides an incentive for suppliers to pay on time and to pay the amount because they know, if they don't, we'll draw down on their credit cover basically. And I think that's worked OK so far."* – Ofgem respondent.
>
> *"So, a lot of the discussion and work was to try and find ways to ensure that the money came in. So, you then have additional obligations on top of that like having to provide credit cover before the obligations to make sure that if they don't pay, then we can drill down on credit cover and recover funds."* – Ofgem respondent.

Given this low level of non-compliance, Ofgem have not had to use any of the specific mechanisms to ensure that it can recover sufficient funds (e.g. credit-cover draw down, mutualisation) and therefore findings on how these processes work is limited. It was expressed by a majority of Ofgem participants however that they did have confidence in these mechanisms to work if they were required.

> *"So, we've not had to test out those more fundamental mechanisms that have been hard wired in so, like the credit covered draw down and the mutualisation."* – Ofgem respondent.

> *"We haven't had to have a mutualisation event yet, which is one of the things that it was designed to prevent or reduce the likelihood of [not having enough money]."* – Ofgem respondent.

> *"We've got the default register. We've got mutualisation, which isn't really a punishment to the supplier that's not paid but does mean that we can get money in if there is a shortfall."* – Ofgem respondent.

Finally, as a measure that would help suppliers in their compliance, one gas supplier suggested that a longer-term view of levy dates would be a useful measure so that compliance can be planned, and reminders set up in advance.

> *"Some more forward certainty about the submission dates would help because it's not reliant upon, 'has person X received the reminder, yes, or no?', and then you are chasing people to say 'oh, have you received the reminder alright?', so if we can look forward one year, 2 years, we could also diarise the reminders for people doing stuff."* – Gas supplier.

DESNZ and Levy Setting

The consistent view across all Department for Energy Security and Net Zero respondents was that the process to set the levy each year worked well, and the steps to set the levy were clear and easily repeatable year-on-year.

> *"My impression is the way we built the modelling for setting the levy rate is really good. It's really well defined […] It's not a scramble to put it together. It's clear throughout the year, we know what data we need, where we need to get it from, how it's used and how that then formulates the levy itself. It's setup in a really good way. It's the GGSS and the budget caps that you have a lot of difficult questions around uncertainty, but the levy, we've nailed it down quite well I think.*" – Department for Energy Security and Net Zero stakeholder.

> *"From the point of view of assessing [the levy], I think the whole thing is really smooth and it's quite an easy process. There's a lot of guides on our side of like how to run the model and how to update everything, so I think yes, the actual setting of the levy itself is really straightforward and actually quite an easy process." […] "we've got the model all in place. We've already got it set up for next year's [levy amount] to come through. So, it is just a case of Ofgem giving us the numbers […] We've got about seven or eight different variables and then you put them all together.*" – Department for Energy Security and Net Zero stakeholder.

> *"Setting the levy was a smooth process and every part of the mechanism has kind of worked as it was designed to do."* – Department for Energy Security and Net Zero Stakeholder.

Department stakeholders also expressed confidence that the levy would do what it was intended to do, in terms of sufficiently funding the GGSS. Respondents described the risk analysis that is undertaken and the processes for building in headroom for unexpected applicants and less meter points than expected.

> *"We do quite a lot of risk analysis around the different options. [The Department] try to work out what's a sensible amount of risk to take. So far, the outturn data has shown we have collected the money we set out to do for the GGSS – not under collected […] We're quite confident the process will sufficiently fund the GGSS."* – Department for Energy Security and Net Zero stakeholder.

> *"We do basically everything we can to make sure there's never too little. We have head room built in to our spend projections on the GGSS. So, we add a little bit extra about 15% more, and then we have headroom on the number of meter points that we project […] Ofgem have a fairly good idea of everybody who's going to apply [to the GGSS]. It just helps if there's a plant that comes out of nowhere and applies to the scheme, there'll be enough money for it. So, you understand, it [under collection] isn't too much of an issue."* – Department for Energy Security and Net Zero stakeholder.

Provisional Exemption

With only one supplier provisionally exempt, there was limited evidence on how this process was working. However, the general view from Ofgem was that again there were no significant challenges in this process. One Ofgem respondent did suggest that the process had been quite burdensome, but overall, the view was that it was functioning effectively.

> *"We have only had one supplier exemption […] From my understanding, the processes have been functioning effectively, with minimal one-off events."* – Ofgem respondent.

One reason suggested for the effective functioning of the supplier exemption measures was the early stage at which the supplier advised Ofgem that they believed they would be exempt.

> *"They did declare that they were provisionally exempt, which is good because what we don't want – what we want to avoid is getting to the end of the year and somebody who wasn't provisionally exempt sneaking up on us and saying, 'oh actually we would be exempt.' We think that's very unlikely, but there is a chance. So, they didn't do that, which was good. [It's a] very small supplier and they engaged with us quite early on to let us know."* – Ofgem respondent.

Ofgem interviewees were unable to comment at the time of interview on the process of validating evidence of exemption, and therefore findings on this are limited.

> *"Only one supplier came forward, presented some evidence which compliance colleagues reviewed, and they were satisfied that they should be granted provisional exemption status. We updated the guidance to set out what suppliers need to provide for exemption purposes. Compliance colleagues are currently reviewing that data at the moment, so it's probably too early to comment on how that bit of the process has gone so far."* – Ofgem respondent.

Implementation of the Green Gas Levy

Ofgem Administration

The consensus amongst Department stakeholders and gas suppliers is that the levy is very well run by Ofgem. Gas suppliers in particular have highlighted how few issues in delivery there have been, describing the implementation as smooth and straightforward. Although some challenges with the implementation were raised, these were all very minor issues encountered by suppliers, which did not have a material impact on supplier experience. A minority, when asked, were unable to suggest any potential improvements to the levy implementation.

> *"In general, it's a well-run scheme.*" – Department for Energy Security and Net Zero stakeholder.

> *"We see the Green Gas Levy as very well managed."* – Gas supplier.

> *"Very satisfied [with Ofgem's role in implementing the levy]. Other than just those suggestions I made at the beginning, everything else has been smooth. So that's very satisfied."* – Gas supplier.

> *"No, I don't think we have experienced any technical issues. It has been smooth."* – Gas supplier.

A point of praise for Ofgem from gas suppliers was the clarity by which the responsibilities and requirements are communicated to them, and the ease of which the requests can be implemented.

> *"So, in terms of is it clear to me what's being charged under each of our licences? Yes, it is. Is it clear to me how that charge is being calculated or generated? Yes, it is. And is it clear to me how we can validate that internally to be able to justify paying that charge? Yes, it is."* – Gas supplier.

> *"Yeah, it's working as you'd expect it. As I say, it's a very simple process to interact with. A tick of a box - that's, that's it, really, as long as I'm happy with the count of meter points and the charges calculated off the back of it. You just take a charge to accept it."* – Gas supplier.

Also referenced by one Department Stakeholder and one gas supplier stakeholder as a positive of Ofgem's implementation of the levy, was the responsiveness of Ofgem to information and support requests.

> *"I think the whole thing is really smooth, I think Ofgem are pretty responsive, pretty quick. [Ofgem] provide us with the data when we when we want it and they give us everything that we need, to keep us in the loop with stuff.*" – Department for Energy Security and Net Zero stakeholder.

> *"[The] team has been good at responding to us when we raise issues."* – Gas supplier.

Suppliers did not identify any significant negative aspects of Ofgem's administration, emphasising the positive view that the market has of levy implementation. It was acknowledged by a small minority of gas suppliers that levy implementation has improved from the initial set up, although these early implementation issues were minor in their overall significance. Some technology challenges have also been highlighted, specifically regarding the portal (i.e. adding new staff as users to the portal, getting access to invoices and data from the portal). The only other real challenge that suppliers expressed regarding Ofgem's administration of the levy was the uncertainty around the proposed change to a Volumetric levy (previously discussed). It should be noted that this policy decision sits outside of Ofgem's remit, and although suppliers may attribute a lack of clarity to Ofgem, this proposition is something that is still being considered and worked on by the Department.

> *"It was a bit sluggish to get off the ground. Their Xoserve solution in terms of the central data provision of meter points […] that never used to exist. So, in the early stages it was up to suppliers to submit their own data […]. Then when Xoserve started to produce the numbers, we had one or two discrepancies."* – Gas supplier.

From the Department's perspective, the only one negative aspect of Ofgem's administration of the levy was the difficulties in setting up a data sharing agreement and getting access to data. It was explained that both setting up the agreement, and also receiving data once the agreement was set up, was slower than it maybe could have been.

> *"We did set up a data sharing agreement, but it did take some time. Longer than it should have. Also, when we ask for data from Ofgem, it's not that easy. I can see it from their perspective, and they have to make sure data is dealt with in the proper way, confidentiality etcetera. But even when we do go through the right processes, it can take some time.*" – Department for Energy Security and Net Zero stakeholder.

Reasons for Successful Implementation

In exploring the reasons why the levy has been implemented so successfully, both Ofgem and Department for Energy Security and Net Zero participants identified the well-defined roles and automated processes that have been put in place. Ofgem respondents explained that it is very clear exactly what their role is, and they have little discretion to deviate from the regulations. This has meant Ofgem can effectively plan, and can follow a pre-determined, repeatable process to implement the levy, as per the annual schedule. Both Ofgem and Department

respondents referenced the automation of processes, and the fact that investment had been made upfront to build systems that make the implementation more straightforward, as important factors.

> *"It was designed to be quite sort of easy to deliver and straight forward, and the regulations are very directive in that way that there aren't many areas for us to have discretion, because we advised DESNZ it would be better if it was very black and white as to what we were supposed to be doing every quarter. So, there's very little room for discussion."* – Ofgem respondent.

> *"I think it's been going very well. And it is quite repetitive really. I mean in terms of what compliance colleagues need to do to get the get credit cover every quarter or make sure to get the data checked. And, you know, issue levy invoices and get the payments in. I think generally it's probably gone OK."* – Ofgem respondent.

> *"We don't have to dedicate too much resource [to the levy], because we did a lot of upfront investment to make sure it's as automated a process as possible. Certain points of the year we dedicate a lot of resource to it, [for example] when policy questions come up. But I think, overall, we deal with it quite efficiently.*" – Department for Energy Security and Net Zero stakeholder.

> *"The levy was designed to be straightforward and can run on rails…"* – Ofgem Respondent.

> *"Processes have changed over time, but a decent amount is automated."* – Ofgem respondent.

The most frequently cited reason for successful implementation was the collaborative nature of levy design and delivery, both between the Department and Ofgem, and in extensively engaging industry stakeholders. Both in the policy design phase and in ongoing delivery, the working relationship between the respective teams was felt to be a key enabler of success.

> *"Policy colleagues in both Energy Department and Ofgem, […] have done a really good job in cultivating a good working relationship. I think that's not something [we] could take for granted and certainly hearing from across the organisation that have been times, as is natural, where those working relationships between the two organisations can be a bit tricky to manage because […] it's a tricky role. You've got one organisation doing the delivery and the other organisation kind of having the final say in setting of all the rules and regulations so. That can sometimes be quite tricky, and I think by and large we've been, we've been really good at managing that."* – Ofgem respondent.

> *"So, it followed the standard governance processes within Ofgem and with our government counterparts, who were BEIS at the time. In terms of how it worked, we had an excellent steering group that met once a month with relevant stakeholders across the business. This group was effective in identifying key challenges, blockers, and getting clarity on the direction."* – Ofgem respondent.

> *"Ofgem were involved really with DESNZ, or BEIS, as they were then as they were developing the policy; they were testing ideas with us, [it was] sort of quite a collaborative approach. We reviewed the draft consultation before they published the public consultation on the levy and the Green Gas Support Scheme. We [Ofgem] provided a response to the public consultation."* – Ofgem respondent.

> *"We make joint decisions, or at least, you know, have collaborative processes. […] I think we work very well together to be honest.*" – Department for Energy Security and Net Zero stakeholder.

Additionally, and as was reflected in supplier views on communications and engagement, stakeholders from the Department and Ofgem saw their active engagement with industry stakeholders to design the levy and test processes as an important factor in ongoing successful implementation. One respondent explained that key stakeholders were identified at an early stage (both external industry stakeholders and internal policy stakeholders), as those responsible for the levy in the early stages sought to bring stakeholders on a 'journey' with the team.

> *"Government colleagues are very engaged and active in making sure the scheme delivers what we want it to, which is useful. This team is very good at engaging with industry and trade bodies.*" – Department for Energy Security and Net Zero stakeholder.

> *"Whilst the portal was being developed, the digital team did reach out for suppliers to get in touch, to be involved in sort of user research type work. Some of it was to understand what their needs would be from the system rather than actually testing something once it was being built. But then there were some user testing type sessions as well to get views on how things looked and whether suppliers are not easy to navigate and that sort of thing as well."* – Ofgem respondent.

An additional success factor that was identified by respondents was the analytical and data-driven way in which the levy is implemented. The data-driven nature of the levy minimises the need for policy decision making, because Department analysts follow modelling based on data from Ofgem, and make decisions (i.e. on levy rate) accordingly. As part of setting budget caps and levy rates, the Department undertakes a range of modelling and forecasting activities, for example, modelling the number of meter points served by gas suppliers; providing GGSS deployment forecasts; and estimating the number of exempt gas suppliers. By following detailed modelling using clearly defined data-inputs and market evidence, many of the policy decisions on the levy rate are driven by this data, with remaining decisions focused on risk appetite and the level of headroom to include.

On the Ofgem-side, they have sought to use previous knowledge and experience of implementing this type of intervention and apply learning to how the levy processes were designed and delivered. Taking this analytical approach gives assurance to decision-makers and ensures that the levy follows best practice where possible.

> *"The levy side is very data driven. There is less room for policy decisions. 'Here's the modelling, here's the data', so we rely on [Ofgem] quite heavily to provide the data and*

> *then it's very data driven, and there isn't that much controversial decisions that you need to make. The difficult decisions are around headroom, and how risky you want to be.*" – Department for Energy Security and Net Zero stakeholder.

> *"[The Department has] got good teams of analysts and they did a pretty great job of forecasting and teasing out the options. There was good oversight from seniors and like I say, it's a pretty strong and careful process that we went through with it.*" – Department for Energy Security and Net Zero stakeholder.

> *"[Ofgem] went into [delivering the levy] understanding what works and didn't from elsewhere…"* – Ofgem respondent.

One final success factor, raised by a small minority of Ofgem participants related to how the levy had been designed. The quarterly lag element of the levy, although acknowledged as complex and in some cases difficult to understand, was explained to be an important safety mechanism to make sure Ofgem has the money in to make GGSS biomethane producer payments. Levy payments aren't received until the second month of each quarter, but GGSS payments may be made in the first month of the quarter, so there is a mismatch in timing of when funds are received and when payments are required to be made. Across multiple Ofgem respondents, there was a desire to minimise the risk of not having the funds to pay biomethane producers on the GGSS, and this is another feature that, into the future, is likely to help with that issue. It was acknowledged, however, that this element, although essential, did make forecasting and administration more challenging.

> *"But one of the aspects of the levy that was designed was for there to be a quarterly lag so that when [Ofgem] get money in, the intention isn't that [Ofgem] have to use that money that we get in within the same quarter. We can get money in one quarter and then we might need to use it the next quarter. I think that's been a good design feature. Just because of timing really because the levy payments don't come in until the second month of each quarter whereas colleagues might need to make Green Gas Support Scheme payments in the first month of one quarter. Theoretically, I think that's probably a feature that is going to help over the years for that in terms of making sure the money comes in and the suppliers pay, for example, the credit cover and things like that."* – Ofgem respondent.

Challenges

When asked on what has been more difficult for Ofgem, in terms of their implementation of the levy, and for the Department in their role, there were few significant issues raised. Most issues were relatively minor and unavoidable challenges, but it was clear that there were little structural issues that particularly impacted on how successfully the levy is being administered.

> *"To my understanding, [there are] no issues, no major issues. Certainly, there have been a little bit [meaning a small number of issues] here and there."* – Ofgem respondent.

As would be expected given the nature of the scheme, one main challenge that was particularly identified by Department stakeholders (although also referenced by Ofgem respondents) was related to forecasting and uncertainty. Given the role of the levy to fund payments on the demand led GGSS, and therefore uncertainty on payments to be made per quarter, uncertainty in forecasting is a feature of the levy. Previous comments have commended the data-driven and analytical nature in dealing with uncertainty, but it does not mean that all risk and challenges that uncertainty pose are eliminated. One department stakeholder commented that forecasting could always be more precise if given more time and resource for granular analysis, but it needs to ensure value for money, in relation to the delivery costs of the levy. This was not a challenge that participants suggested could be easily addressed but highlighted it as a feature that made administration more challenging.

> *"There have been difficulties around the fact that there were uncertainties about how much money was needed to be collected by the levy.*" – Department for Energy Security and Net Zero stakeholder.

> *"In an ideal world, we'd have - we'd be better resourced, and we'd be able to do possibly more sophisticated, more granular analysis. I think one of the problems of setting the levy is that we need to make a forecast of what we expect applications to be… [more granular analysis] would mean that we'd be more confident of our forecasts, which means that we'd be more likely to set a levy rate that was closer to what was needed. So, then we wouldn't face the position where we have collected too much, and we have to manage that."* – Department for Energy Security and Net Zero stakeholder.

> *"So, one of the big challenges [Ofgem have] had is the amount of estimates we've had to produce on the [Green Gas Support] Scheme side for what we think is going to go out and for different purposes. So, we have to provide an estimate to the [Department for Energy Security and Net Zero] for their levy setting. We then have to provide an estimate for our internal finance estimates. Those have to be slightly different. The levy setting has to be like a maximum. The finance one has to be a sort of best guess."* – Ofgem respondent.

Both the Department and Ofgem raised separate challenges faced relating to data. Both involved data access. Two Department stakeholders specifically highlighted challenges in terms of setting up the data sharing agreement and getting regular access to data. The issue is framed as one that had been challenging, but is now resolved, and indeed, evidence from elsewhere on how Ofgem data is shared with and used by the Department shows that now data-sharing is less of a specific challenge. However, it is certainly the case that it required a significant amount of effort initially in order to resolve, including listing each variable that the Department may wish to have access to. It is important to note that, as acknowledged by one respondent, Ofgem's care in dealing with potentially sensitive data is important and merited, but for future policy development, it is important to arrange the data-sharing agreements ahead of time.

> *"[The Department] set the levy rate, but I think it does flag that there is actually– we are quite reliant on Ofgem for data. We did set up a data sharing agreement, but it did take*

> *some time. […] If I was setting up a new scheme, I think I would try to get all of that agreed with Ofgem ahead of time. [I would] Have the data sharing agreement more formally agreed before the scheme launches.*" – Department for Energy Security and Net Zero stakeholder.

> *"There were some difficulties with actually getting the data sharing agreement sorted; that took ages. To be honest though that went through a lot of redrafting and things like that because it had to specifically state every single variable that we wanted in the data sharing agreement and if there was one that like we wanted, but it wasn't on this document, then [Ofgem] legally couldn't provide it was or didn't have to if we asked for it. So, we had to go through the entire thing and make sure that everything they were giving us was what we wanted. So, that that was quite like a long-winded process, but now that's sorted.*" – Department for Energy Security and Net Zero stakeholder.

On Ofgem's side, issues with data were the most frequently cited challenge in terms of administration. The exact nature of issues varied, but all related to the data that was available on gas suppliers and meter points. Again, this was posed as a challenge in the early stages of the levy that has largely now be resolved. Issues identified included the poor data that some suppliers had on file related to the number of meter points that they serviced, which meant Ofgem could not have full confidence in the data that they were receiving (prior to the introduction of Xoserve data and supplier validation).. The final data-related issue was on the availability of data on gas suppliers, and particularly smaller suppliers, to direct communications to on the levy. As these challenges are largely now resolved, there are no specifics that should be addressed.

> *"In terms of the data, I think that's working well. It took a while… we needed to set it up at the beginning."* – Ofgem respondent.

> *"The only aspect that stands out […] is the verification of meter supply data. One would expect suppliers to have this data readily available, as they should know who they are supplying to. However, the quality of records varies among suppliers. […]. We are aware that some suppliers have less robust records than others. To address this, we anticipated the need to use Xoserve data to facilitate data submission by suppliers. We gained more confidence in the data through the involvement of Xoserve, […]. During the initial months of implementation, we had to facilitate conversations between some suppliers and Xoserve to ensure mutual understanding of the information being presented and any necessary adjustments and whether tweaks needed to happen."* – Ofgem respondent.

> *"The accuracy of records and their continued operation was difficult to ascertain. We gathered information from various departments involved in regulation, but even they lacked comprehensive and up-to-date data on smaller suppliers. Overall, this aspect proved to be the most challenging."* – Ofgem respondent.

Another challenge raised by both Ofgem and the Department regarding implementation of the levy was the challenges and complexities relating to Treasury rules of returning surpluses and

being repaid the following financial year. Discussion has already touched on overcollection, and the fact that it is not a challenge in and of itself as surplus funds are eventually fed back into the levy. The particular challenge raised related to the precise processes of how the Treasury, the Department for Energy Security and Net Zero and Ofgem interact to comply with the Treasury rules. It was felt that this year, given it was the first time completing the process, compared to most other elements of implementation that have been relative smooth, this process was unclear and cumbersome.

> *"So, the over collected levy amounts. The process actually has been a little opaque to me, personally. The process Involves - I mean, in theory like it's very simple, the money's rolled over to the next year." […] "All of the surplus has to go back to the Treasury at the end of the financial year, the end of March. And then the Treasury gives the amount that Ofgem needs for the next financial year back. So, in reality… the realities of communication between two different central government departments and arm's length [body], there was a bit of a gap, I think this year in terms of having a shared understanding of how that process [of returning surplus] works and what was needed when, that's been one of the slightly more challenging elements of I think this year because it's our first [year] rolling over. [It] was a bit of a learning Process.*" – Department for Energy Security and Net Zero stakeholder.

> *"The formula is designed to account for the surplus we've collected. However, there is a lag in how it's accounted for, and it takes a couple of years. If we're collecting taxpayer money and sitting on it for two years without utilising it, that doesn't look good. […] We're not allowed to roll the money over year after year; we have to return it to the Treasury, even though the Treasury never had it in the first place. The funds go into a consolidated fund, and we can access it later. But the scheme is designed to hold onto surpluses over time, even though we don't have access to that money anymore since we've sent it back to the Treasury. It creates a challenge in terms of how the scheme was designed and the interaction with year-on-year rolling of funds."* – Ofgem respondent.

One final challenge raised by a minority of Ofgem respondents was the tight timelines for implementing the levy. Given Ofgem had a role in implementing both the Green Gas Support Scheme and the levy, in a relatively short space of time, there were some difficulties in terms of having enough time to get to grips with the final legislation and design systems that would support delivery. Given the dual priorities of the Green Gas Support Scheme and levy, resources were directed towards the Green Gas Support Scheme as a priority, which meant that the levy in the early stages after launch was at a 'minimum viable product' stage in terms of the systems set up, and there was not full clarity on how Ofgem would use the systems developed. Again, this is not an ongoing issue, and Ofgem were able to still deliver what was required, but it was more challenging given the tight timelines.

> *"'I'll start with the challenges; the timelines were very tight. The legislation - I can't remember if it was actually delayed or whether that was the plan all along, but [the legislation] was passed reasonably late in the day, so there wasn't a huge amount of time to work through and make sure that everything worked. [...] I don't think there are*

> *any problems per se with how it had been written, but there wasn't a huge amount of time to be 100% clear on that [at the time].*" – Department for Energy Security and Net Zero stakeholder.

> *"[Ofgem] didn't really have systems in place by the time [the levy] launched, again because timelines were fairly compressed, and a lot of resources, if I remember correctly, focused on the external users' side for the Green Gas Support Scheme as opposed to the levy. And I don't think there was a whole lot of development work done on our side on how Ofgem would use the systems internally." […] "There was kind of a minimal viable product I guess which was fairly light touch*." – Ofgem respondent.

Opportunities to reduce the burden on Ofgem

The most common response to exploration of ways in which the Department could better support Ofgem in the implementation of the levy was that no additional support was required, explaining that the status quo in terms of division of responsibilities was working well, and that it was the role of Ofgem to deliver the levy. It was expressed that Ofgem do feel that the lines of communication, should issues arise, are open, and that indeed the issues that they have expressed regarding implementation previously have been taken on board by the Department (e.g. regarding de minimis rules).

> *"In terms of delivery, I think that falls to Ofgem. That's our role and the Department doesn't have a role in delivery, so I don't really remember there being any support."* – Ofgem respondent.

> *"On a regular basis we probably don't really need a lot of support in a way because our role is to administer as set out in the regulations and generally. We haven't had a lot of questions about interpreting the regulations that we've not been able to answer ourselves. We haven't needed a lot of support really."* – Ofgem respondent.

> *"I think we get enough; we get what we ask for […] In terms of getting support, we've got some really good contacts." "I don't think [the delivery] can be massively improved on short of having everybody's workloads [reduced] […] But yeah, generally a really good relationship and pretty good in terms of getting what we need on things."* – Ofgem respondent.

For those suggesting changes and potential ways in which the Department could better support Ofgem, the suggestions were all very minor in scope, reflecting the success of the current implementation model. Suggestions included introducing de minimis rules, providing Ofgem more flexibility in terms of getting payments in very specific circumstances, and correcting minor formulas.

> *"So, I think that's reflected in the fact that the Energy Department (DESNZ) contacted us to say, "have you got any changes that you'd like to suggest for the scheme review […], we'll sort of see if there's any changes or anything that's not working that [the Department] can fix". And I think the fact that everything that's been suggested is pretty*

> *minor. […] there are sort of minor tweaks that could give us a few more levers, a bit more leeway. Those are the sorts of things…"* – Ofgem respondent.

It was suggested that there may be opportunity for more administrative processes to be automated, and that based on some supplier feedback, minor tweaks to the portal could be implemented to improve supplier experience (e.g. adding a feature that shows when tasks on the portal have been completed so suppliers can see what still needs to be done). Each of these adjustments were all felt to be minor changes.

Supplier Experience of the Green Gas Levy

Costs to Suppliers

The overwhelming consensus among gas suppliers interviewed was that the Green Gas Levy represents a relatively minor cost to their organisation, a viewpoint that was consistent across larger and smaller gas suppliers. Gas suppliers explained that both in terms of the actual levy cost and the costs that suppliers face to administer the levy, both are viewed as insignificant costs, as reflected in the below interview extracts:

> *"In all honesty it's a very small premium to pay to start to inject the biomethane into the NTS [National Transmission System]."* – Gas supplier

> *"So obviously the levy is based on the number of meter points that you have and the number of days that you're supplying the meter points, and so, because we have so few gas customers on supply, it makes the cost very, very small for us."* – Gas supplier

> *"Getting rid of this charge isn't going to put money in anyone's back pocket."* – *Gas supplier*

Extracts from various supplier interviews below highlight the straightforward and minimal effort required to meet levy obligations. In no cases did suppliers express an opinion that they faced a disproportionate cost to comply.

> *"So, across all of our obligations, this one's quite a cheap one to deliver, because it's just a case of here's the number. Here's the cost. Validate the two. There's nothing more to it than that."* – Gas supplier.

> *"The only cost would be for me to quickly calculate it. Here's the number. Here's the number of meter points and here's the confirmed levy rate. Very small, very minute likely probably a 15-minute job at most."* – Gas supplier.

> *"It's a relatively simple thing and to, to be honest, it's just a case of us calculating our customer liability with the live meter points on each specific day and then comparing that to whatever Xoserve provided, which is fine"* – Gas supplier.

> *"Overall, the Green Gas Levy is a very small thing for us, and we don't see it as a faff, it's really simple."* – Gas supplier.

Although suppliers have had to absorb the time and effort required to set up, administer and meet ongoing obligations for the levy, there were no reported instances of gas suppliers increasing their headcount in order to comply. A significant minority of suppliers specifically pointed out that they had not increased their employment in order to comply.

> *"I guess it's using existing resource but also using some of their time. I don't think it uses a huge amount of time. From my point of view, in forecasting, we haven't had to recruit more forecasting resources to do so, it has been accepted into the existing resource. From a settlement and data submission point of view, [it's a] similar story but there is a time element of it. So, a small cost in the existing team that stretches out the costs more."* – Gas supplier

> *"[The administrative requirements] have overall been absorbed in the current company head count, [and therefore there has been] no more employment."* – Gas supplier

As would be expected, the most significant cost that suppliers referred to, was the initial set up cost. Examples provided included the time costs of reading and understanding requirements, the costs associated with adjusting pricing (including forecasting for fixed contracts), sorting data for new back-end systems, confirming governance and approval processes, and developing explainer materials. However, following these initial costs, a majority of suppliers explained that now that the process has been embedded into their organisation, and automated where it can be, the ongoing effort and costs have reduced.

> *"The cost of the of sort of running the scheme - so I mean every quarter we do the […] MPRN [Meter Point Reference Number] count, which is also more or less automated now, but it involves actually going on to the portal and putting the putting the numbers in."* – Gas supplier.

> *"Scripting has been developed. It's a quick and easy thing to push a button and away we go. We get our data. For me to actually submit the data and you know, obviously it's a validation process, but it may take me a grand total of an hour or two to wrap the process up from start to finish."* – Gas supplier.

> *"Because it's been pre-existing for a while, the payment of it is an embedded process. If we were having to start this again from fresh, I think it would perhaps be more complicated than it needs to be. But everything's set up from our point of view… it's a business-as-usual process to get it done from our point of view."* – Gas supplier.

It was also highlighted by a number of gas suppliers that once the 'Xoserve' data provision was set up, compliance costs were further reduced, given it is easier to validate a number provided, than produce the number oneself.

> *"I think […] it's better that we get that central view of [meter points], you know, from Xoserve. Getting a central view is more efficient than having every supplier running around every quarter trying to, you know, [gather the data themselves]."* – Gas supplier.

> *"I think obtaining the data from direct from Correla and so forth for Ofgem to produce the bill based on industry available data and then presenting it to small businesses for them to validate if you like – cross check against their own records – is inevitably going to be less effort for the small business than for them to be sourcing that data directly themselves. Now it might seem to be like the same thing, but it is easier to generally check something that's been provided than it is to start from scratch."* – Gas supplier.

> *"[It's] better to validate the number that Ofgem provide us. They have the data, so it's better for them to provide us with the number and we validate it."* – Gas supplier.

One counterpoint, raised by one supplier, was that despite the small relative costs of the levy, compared to other obligations on energy suppliers, the cumulative effect of multiple obligations puts an increased burden on suppliers, and therefore the costs to suppliers of this levy should not only be considered in isolation.

> *"Specific administrative cost of [the Green Gas Levy] is the cumulative effect of sort of layer upon layer of regulatory requirements that tip you over the edge to more resource requirements" […] "So even though it's the first levy on gas, we've got tonnes of these things to manage on the electricity as well. So, it does layer up the admin costs and of all the different government schemes which suppliers have to bear the pain of."* – Gas supplier.

Administrative Burden on Suppliers

The consistent view from Ofgem participants was that the burden that the levy places on suppliers is relatively minimal. It was explained that this was due to a conscious effort to ensure that the levy was proportional and the cost of administering it was not greater than the payments that suppliers made.

> *"It's relatively easy for suppliers to implement. They simply calculate the levy rate based on their number of customers and pass it on accordingly."* – Ofgem respondent

> *"From a supplier perspective, I believe the complexity primarily lies on our side rather than theirs. Ultimately, if suppliers have sufficient credit cover and make timely payments it's not that much work for them."* – Ofgem respondent.

> *"You'd think it would be quite minimal because we're asking them to check data on a quarterly basis and you would have thought that someone within the organisation should have those numbers and be aware of that already, and they have to potentially top up credit cover"* – Ofgem respondent.

> *"The system that's being built is considerably better, in my opinion, than previous systems we've built. It's pretty streamlined, straightforward to make an account and set everything up, and all [a gas supplier has] to do is follow the instructions in the user guide."* – Ofgem respondent.

Generally, the majority of suppliers have concurred that the levy systems and processes are working effectively and efficiently. Particularly, regarding providing and validating data, suppliers spoke positively about systems that are in place, and did not highlight any significant challenges or hurdles that they faced.

> *"The portal works well. There's nothing unexpected that comes out from it. We know what we have to do. We send in our quarterly data, we get the invoice back, we pay it and then we don't hear about it for another 10 to 11 weeks, which is absolutely perfect for us. We see the Green Gas Levy as very well managed."* – Gas supplier.

> *"Everything's always worked and it's a case where we get an e-mail saying 'we've been provided with your daily meter point count by Xoserve. Here's your opportunity to review that against what you believe it to be.' Very simple, very, very simple. There's nothing over the top. There's no grandiose formula approach that I need to consider or anything. It's just as it's just as simple as it states on the guidance."* – Gas supplier.

A minority of suppliers did raise the issue of discrepancies between internal figures of meter points, and those provided by Xoserve. It was stressed that discrepancies are often very minor and do not have a material impact on suppliers, given the small costs per meter point. One specific difference in the ways meter points are calculated, one supplier believed, was in the different definitions of what constituted 'live-on supply' meter points between the supplier and Xoserve.

> *"The main task is just reconciling small differences between the Ofgem view of the number of eligible [meter points] and our view of the number of eligible gas meter points, and this is always a slight discrepancy…"* – Gas supplier.

> *"The main challenge is the submission of the data and to get numbers to align to the Xoserve data, but they are more or less aligned; two data sets never perfectly algin."* – Gas supplier.

One supplier did express a concern that, if the internal and external views were particularly far apart, such that they would have a material impact on the gas supplier, that it would be difficult to reconcile the two. This was not something that the supplier had directly experienced and there was no evidence that this would be the case.

> *"Should we need to challenge it though, I think it would be quite costly [be]cause I should imagine there would be quite a back and forth between ourselves and the government in terms of understanding exactly what it is that we're challenging." […] "If things did get awkward and the count of meter points out either side were significantly different. I think that's where the cost would really come in."* – Gas supplier

All suppliers were asked if any changes could be made to the levy to reduce the administrative burden placed on suppliers by it. Half of the suppliers felt that there were no significant changes required, one of which felt that to make any significant change now, once processes have already been set up, would place more burden on suppliers, rather than less.

However, a number of tools to support and help lessen the burden on suppliers were suggested. Several suppliers did highlight the potential need for more certainty for future dates and costs. A longer-term view of dates was highlighted as useful for planning and automating processes.

> *"Some more forward certainty about the submission dates would help because it's not reliant upon has person X received the reminder yes or no, and then you are chasing people to say 'oh, have you received the reminder alright?', so if we can look forward one year, 2 years, we could also diarise the reminders for people doing stuff."* – Gas supplier.

More frequently requested was a longer term forecast of levy costs, particularly to help with adjusting pricing for bills.

> *"When we're contracting with customers, we're fixing prices going forward, we sometimes do that for three to four years out, and I'm not sure that we have much visibility around the cost projections or the total scheme costs over that sort of timeframe. So, I mean, if there is something [published] a little bit more longer-term in terms of scheme costs… that would be quite useful"* – Gas supplier.

> *"It's a small cost relative to other industry levies, but longer-term time frame would be quite useful on scheme costs."* – Gas supplier.

> *"[There's] not much forward forecast of the charges after initial documentation." – Gas supplier.*

A number of more fundamental changes to help reduce administrative burden were also raised, although in these cases by a small minority of suppliers. One supplier, although acknowledging the benefits of quarterly payments in the context of mutualisation, suggested that given the size of the levy, an annual process might be more "cost effective" and proportional than quarterly requirement.

> *"I wonder given the size of the scheme, or the magnitude of the scheme, might annual processes work better [to reduce the burden on suppliers]."* – Gas supplier.

Another more fundamental change suggested to minimise burden was the introduction of a 'de minimis' rule for the levy to take the burden off suppliers with a small number of meter points. This specific change was only referenced by Ofgem respondents as something that would likely reduce burden. However, in the evaluators experience of securing interviews for this research, a number of suppliers declined to participate, stating that given their liability on the Green Gas Levy was so small, it was not deemed worth their time to participate. Smaller gas suppliers who did participate, whilst not directly suggesting that a rule of this nature be introduced, did emphasise that the costs of the levy to themselves were minimal.

> *"Our last invoice was about [redacted – less than £10.00], so I'm going say that we sucked it up [meaning that any challenges in the process were not taken too seriously]."* – Gas supplier.

It should be noted that following this analysis, de minimis rules were added to the GGSS regulations as part of the 2023 amendment.

Timing

Suppliers were asked to comment if the timings of each of the GGL requirements were sufficient or if they posed any difficulties to their organisation. A significant majority of suppliers felt that the timings for various levy requirements were appropriate and enabled their organisation to meet deadlines relatively easily. One supplier did suggest that although they were able to meet deadlines on submissions, in some cases it can be quite a challenge to do so, but this was a minority view.

> *"[This organisation] seems to be able to hit the deadline."* – Gas supplier.

> *"It's always a challenge for big organisations to get the appropriate approvals in time for these things, but there were no issues."* – Gas supplier.

> *"[We're] not sitting here saying we can't do it [meet the deadline], [it's] not comfortable but its reasonably sensible. If they gave us an extra week, we would take it."* – Gas supplier.

One supplier also specifically commended the levy for the clarity of timings provided in the timetable. However, as was discussed above, a small number of suppliers expressed that they would benefit from timetables that were longer-term, to have an extended view of actions required to comply with the levy.

> *"There are really clear timetables. There's really key actions that were laid out when we needed to and confirmed credit cover requirements when we needed to provide credit cover. It's just a well-managed scheme."* – Gas supplier.

Interaction with Customers

As expected, all suppliers passed their levy costs on to customers, when possible, but the methods by which costs were passed on are nuanced by the type of contract (and generally type of customer) as well as by organisation. For those offering fixed price contracts, the general approach for suppliers was to take a view of what the levy cost would be and build this cost into the standing charge. Suppliers generally tried to forecast forward when doing this, but a number highlighted the importance of having a sense of future levy costs to enable this. For customers with pass-through contracts (generally commercial customers), costs do get passed through.

> *"They will be fixed for the customer by us – we will price in our best forecast for them with a risk premium to price uncertainty around it and will bear cost of errors."* – Gas supplier.

> *"But also, we do fix costs as well for customers who are on fixed price contracts. So, we have a variance in terms of the way that we charge out. I don't pass through all fixed*

> *costs and so forward notice on charges is really important for the fixed price."* – Gas supplier.
>
> *"They are passed on, but it's a case of we have a view of the GGL rate built into the standing charge and like we have not passed it through to any end users like you would with CCL [Climate Change Levy]."* – Gas supplier.
>
> *"So, we do pass through costs where, you know, wherever we can, for our customers who have pass-through contracts."* – Gas supplier.

It was also mentioned by two suppliers that the scale of the costs to individual customers is generally not noticeable, and therefore the way by which costs are passed through are unlikely to incite any challenge.

> *"The scale of costs for the majority is not a big cost or noticeable."* – Gas supplier.
>
> *"[There are] no significant costs worth highlighting, customers don't query it as of the scale of it."* – Gas supplier.

Although not explored in interview questions, the topic of transitioning the GGL to a volumetric, rather than per-meter-point levy was raised by a number of suppliers, highlighting their concerns with this approach. It was highlighted that this would be much more challenging in terms of billing. As previously mentioned, for suppliers that aim to fix their prices multiple years in advance, transitioning to a volumetric levy will have a particularly negative impact.

> *"Changing the way, the charging mechanism works won't be cost effective. We'll have to change our billing system. It becomes a bit unwieldy for the magnitude of the scheme."* – Gas supplier.
>
> *"[The minimal pushback from customers] will change when [the GGL] becomes volumetric as it becomes a significant cost for some customers, then the investment we would need to put it will have to increase."* – Gas supplier.
>
> *"When [the gas supplier is] contracting with customers, we're fixing prices going forward, we sometimes do that for three to four years out and I'm not sure that we have much visibility around the cost projections or the total scheme costs over that sort of time frame."* – Gas supplier.

One final point raised by two suppliers regarding how costs were passed on to customers was the Energy Price Cap. They highlighted that given some customers are already at the Price Cap threshold, the supplier is unable to pass through some or all of the Green Gas Levy costs[12].

[12] Although this finding reflects comments from suppliers, it is important to note that the levy is included in the formulation of the price cap, and therefore the costs are accounted for in consumers paying at the price cap level.

> *"Yes, that's [question on how costs are passed on to customers] a price cap question. Whatever could be passed on within the price cap."* – Gas supplier.

> *"The slight nuances are that many of the residential customers are on the default cap currently which is out of our control in terms of what we recover."* – Gas supplier.

Communication of the levy to Suppliers

Ofgem interview participants described how they undertook extensive stakeholder engagement prior to the implementation of the levy, proactively engaging a wide range of suppliers and leveraging existing relationships to do so. Although Ofgem struggled in some part to engage with smaller organisations given their limited capacity to engage, they did not report receiving any significant negative feedback at this stage.

> *"So, we issued two consultations on it. So, I think that was fairly comprehensive and we had a workshop with industry which was primarily with industry bodies."* – Ofgem respondent.

> *"Initially, we proactively reached out to all suppliers via email, rather than waiting for them to request account setup."* – Ofgem respondent.

> *"Ofgem already had established relationships with suppliers, so we were able to engage with them effectively. However, a challenge arose when engaging with smaller organisations within the supplier groups. These organisations have limited capacity to provide input, review guidance documents, or participate in consultations."* – Ofgem respondent.

> *"We had good attendance at [an industry workshop] and there was some reasonably strong views, but I don't think we had any real push back on the plan. I think everyone accepted that this this was going to happen and understood the rationale behind it, and there was also recognition that it wasn't going to cost very much, which is always nice for them. There were two strands of engagement that I think were quite useful."* – Ofgem respondent.

In general, Gas Suppliers concurred that the pre-implementation communications had been sufficient to meet their needs. The evaluation did not find evidence of suppliers wishing to have engaged prior to implementation, but not having an opportunity to do so. There was one instance of a supplier not receiving some early communications to their inbox, but there were no negative impacts of this.

> *"Pre-implementation, [there was a] reasonable amount [of communication on the levy]. [There were a] couple of consultations we attended and responded to them. There was good information in terms of impact assessments and how we would charge different levies and how that would work. That was all useful."* – Gas supplier.

> *"So, I was involved really in the early stages in terms of policy development with what was BEIS at the time on the Green Gas Levy. So, I was in at an early stage actually in*

> *one of the focus groups – Supplier Focus group – so it didn't come as a surprise to me."* – Gas supplier.
>
> *"I went to the webinar, and I remember about how portal access was going to work. So, we definitely went along to one of them and we read the brief things that came out."* – Gas supplier.

Generally, it was felt that communications on the levy had been timely enough to put processes into place. One supplier referenced that some longer-term contracts were minorly impacted by the levy introduction, but overall, this was not deemed to be a significant failing.

> *"I can't recall exactly when we first became aware of it. But what I do recall is that it was good to get engagement as early as we did."* – Gas supplier.
>
> *"Just about good timing in terms of communications. There was sufficient time for us not to be impacted, some two-year contracts were impacted a bit but not massively."* – Gas supplier.

Post-implementation communications also seem to be positively received by gas suppliers. Two suppliers specifically have commended the clarity with which the levy is communicated and said the levy has been easy to understand. As one Ofgem participant pointed out, the fact that non-compliance has been minimal also shows that the communications have been sufficient. Ofgem have also been praised for their responsiveness to suppliers on an ongoing basis to resolve issues and answer questions.

> *"It's relatively simple and logical, to be honest with you. I'd be surprised if people were making any errors on to be honest with you."* – Gas supplier
>
> *"[There has] been some non-compliances but [this has] been minor. These are usually at beginning of the [levy], more complicated schemes usually get a lot more non-compliance. [Suppliers] seem to know their obligations pretty well."* – Ofgem respondent.
>
> *"Whenever I've asked any questions [Ofgem] have come back to me within two to three days."* – Gas supplier.

The main criticism of the communications around the levy have focused on the uncertainty regarding a transition to a volumetric levy. The lack of certainty and communication around this point poses a challenge to suppliers.

> *"In the consultation stage early on, it outlined an entirely different way of implementing the GGL and settled on the pence per meter basis, but in 2024, [the levy] could go to a volumetric charge. We don't really know if that's going to happen or if it won't or if there will be a consultation to discuss this further. So, there are some open questions in the early consultations that haven't been revisited and haven't had great certainty on. This makes it challenging in terms of forecasting and it adds on risk. It's bad for us but also bad for the customers."* – Gas supplier.

> *"If [Ofgem] could say volumetric isn't coming for another X years, then that would help with internal planning. Now it's left for 2024 but that is soon when we haven't had any info about it."* – Gas supplier.

One final negative reflection on the communications, raised by a minority of gas suppliers is the way in which the purpose and benefits of the levy are communicated to suppliers and to customers.

> *"If I were asked for or pushed to explain what value does [the Green Gas Levy] deliver for either a customer or supplier, that's sort of draws a blank from the information that is available [online guidance materials]." […] "When we look at that portal [it is assumed that 'portal' is meaning to refer to GGSS quarterly reports] on face value with it, the portal looks like it's to be running just shy of a £47 million cash surplus. So, what value does that deliver to the industry if all this money that would be in is just generating a higher and higher and higher surplus."* – Gas supplier.

> *"The Green Gas Levy is completely immaterial and in making any of our customers think about moving away from gas and towards electrification of heat, for example."* – Gas supplier.

Guidance on levy for Suppliers

Related to the above discussion on communications, suppliers in general have found that the guidance materials published online have been useful and fit for purpose. Most suppliers that engaged in interviews reported using the guidance as a key tool in understanding how the levy is intended to work and the actions that they needed to take to prepare and provide payment for the levy. There were minimal responses that highlighted any difficulties, with one supplier suggesting that in some cases language could be simplified, and another suggestion that the guidance could more effectively explain how the portal works, particularly for those who may be newly coming into an organisation to work on Green Gas Levy compliance.

> *"[The guidance is] quite good at explaining how the process works particularly around credit requirements. So yeah, I think it's sufficient."* – Gas supplier.

> *"We were notified of the scheme going live, [it was] just a case of […] reading through those Ofgem publications just to make sure that we were calculating, 'oh, this is how you need to do it. This is how you calculate your credit cover. This is how you - this is where you can get the published rates from etcetera'. And so yeah, everything was fine on that front."* – Gas supplier.

> *"To sort of get to grips with what the scheme is in a bit of the context, yes, I have had a root around through the portal and looked at the guidance documents and they didn't cause me too many problems."* – Gas supplier.

> *"I think [the guidance] was used for understanding what the proposals were."* – Gas supplier.

One supplier also highlighted that the quarterly reports on the Green Gas Support Scheme were a useful tool for their organisation, particularly to help with tracking scheme budgets to help with future forecasting.

> *"The quarterly report that they publish, we use in part for the budget information such as allowed or maximum budgets, to see what the future years could be."* – Gas supplier.

Energy Price Guarantee

Suppliers were also asked to comment on how the Energy Price Guarantee (EPG) had been implemented and the relationship that it had with the levy. Not all suppliers were able to provide certainty on the process by which EPG money for levies was used, but there was a consensus generally that both in terms of bills and payments, the EPG processes were separate from the levy.

> *"The way we view it is that the revenue that is coming in is still the default tariff cap level that includes the levy, the EPG just changes who is paying us that revenue really. So, rather than the customer paying all of it, the customer is paying up to £2,500 and then the government is paying the rest to us. Nothing has changed in terms of how we forecast the levy around the EPG, it is just the assumption that someone is going to pay us the money."* – Gas supplier.

> *"No impact really – anything on government schemes been done at end line adjustment, hasn't gone through the original calculation; the same process can be applied. Scheme costs to us don't change… Not sure how we used the funding, but there's nothing specific to GGL and how it works; we don't segregate it down to the lower levels. Because the scale of this charge is so small to other costs it's not a concern that we need to ensure the flow is working correctly."* – Gas supplier.

> *"The [EPG] scheme does not affect anything we have done around GGL."* – Gas supplier.

> *"The Green Gas Levy is an industry levy that is within a budget for industry levies... we will be using money received from the government to offset funds that we have set aside for paying [industry levies]." – Gas supplier.*

Equally, there was limited certainty as to the extent to which the role of the EPG in covering the GGL was communicated to customers, but for the three suppliers that were able to speak to this, none of these communicated to customers the role of the EPG in relation to the Green Gas Levy.

> *"It's [communicated] in the standard communications that go out that is governing what the customers are paying to us. Any kind of help or advice is referenced there, but not with any specifics to the levy."* – Gas supplier.

Annex 6: Application and Monitoring Data Analysis

Green Gas Support Scheme

Applications and Lead Times

Table 9 describes the total applications received under the GGSS as of end of July 2023 and the accumulative number of applications that have progressed through each of the three stages. The GGSS has received 25 individual applications and has granted provisional tariff guarantee to 20 of these applications, and full tariff guarantee to 13. Only 1 plant has successfully completed stage 3 of the application process, commissioned their AD plant, and registered onto the scheme to begin generating and injecting biomethane to the gas grid.

Table 9: Total Applications Received and Granted

Application Stage	Total Received	Total Granted
Stage 1 (Provisional tariff guarantee)	25	20
Stage 2 (Full tariff guarantee)	20	12
Stage 3 (Registration)	2	1

Source: GGSS Application Data, July 2023[13]

Although 25 individual applications have been received in total (inclusive of those rejected, withdrawn and where tariff guarantee was cancelled or revoked), a number of these are re-applications from investors who were unsuccessful with previous stage 1 or stage 2 applications. Table 10 shows the current status of applications, based on the stage that applicants are at for their most recent application (where they have applied multiple times). 18 unique AD plants have applied to the scheme to date; 5 of these were rejected in stage 1, of which 1 reapplied and 4 did not. 7 AD plants were not granted full tariff guarantees, of which, 6 have reapplied and have now received full tariff guarantees (and 1 plant has not re-applied following a full tariff guarantee application rejection). 11 plants have received their full tariff guarantees and are currently in the process of commissioning their new AD plant to complete their registration to the scheme, and 1 plant has successfully registered.

[13] Provided by DESNZ by a bespoke data request.

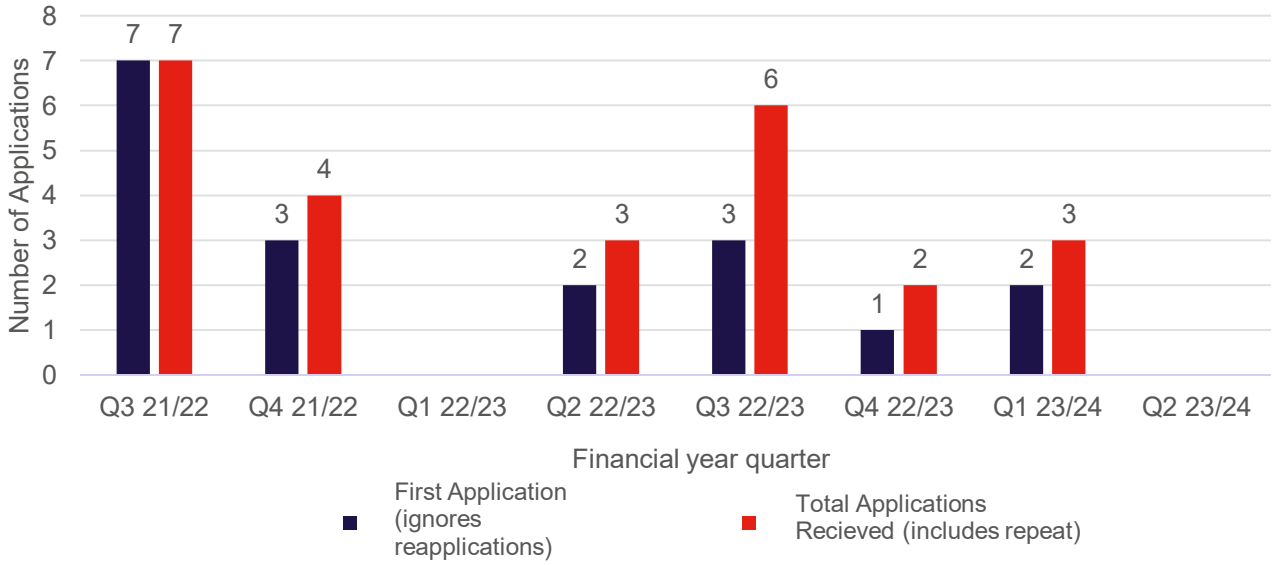
Table 10: Application Current Status (as of July 2023)

Applicant Status	Total
Rejected Stage 1 (no reapplication)	4
Stage 2 Application Ongoing	0
Rejected Stage 2 (no reapplication)	1
Stage 3 Registration Ongoing	11
Successfully Registered	1
Total Unique Applicants	**18**

Source: GGSS Application Data, July 2023

Figure 12 shows the timings (by quarter) that applications to the GGSS were received. The graph presents the first time an AD plant submitted their provisional tariff guarantee application (excluding repeat submissions) to show the point in time at which the scheme was reaching applicants, and the total applications received per quarter (including re applicant submissions). The first year of the scheme (FY 2021/22) saw 10 different AD plants submit applications, with 6 additional plants applying in FY 2022/23. Although data is incomplete for FY 2023/24, 2 new AD plants have made applications to the scheme so far.

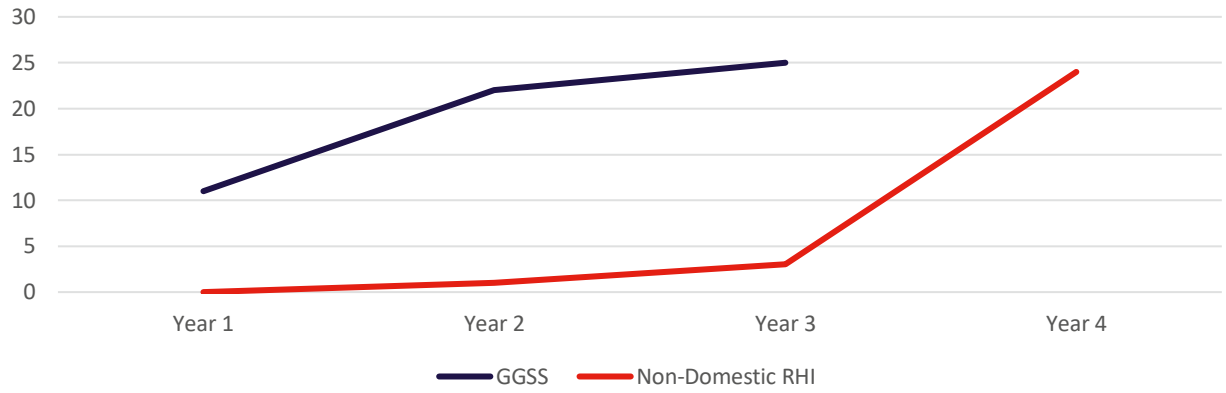
Figure 12: GGSS Provisional Tariff Guarantee (Stage 1) Applications Received by Quarter



Source: GGSS Application Data, July 2023

Although applications to the GGSS may be smaller than expected, as shown in Figure 13, the number of applications in the first three years of the GGSS exceeds the same period on the ND RHI (2011 to 2014).

Figure 13: GGSS Applications Received Compared to the Non-Domestic RHI (cumulative)



Source: DESNZ, 2023. ND RHI Monthly Deployment Data: March 2023 (Quarterly edition)[14]; GGSS Application Data, July 2023

Table 11 details the average time (in weeks) that it has taken GGSS applicants to progress through the various stages of the three-stage application process. The time taken from initial application to notice of receiving full tariff guarantee (i.e. initial application to stage 2 decision, after which plants can start construction in order to register onto the scheme) is close to nineteen weeks (just under four and a half months). Given only one plant has completed the final (registration) stage of the application process, commissioning their plant to begin generation and injection, the evaluation can say with much less certainty the average time taken to move between these stages. At present, 11 AD plants are in this stage of their application, and have taken on average, more than 32 weeks (over seven months). However, this ranges significantly, with the longest lead time recorded as 488 days at the end of July (over 16 months) and the shortest just 41 days (over one month).

Table 11: Average Time Taken to Complete Application Stage (weeks)[15]

Application Milestones	Duration (weeks)
Stage 1 Application Submission to Stage 2 Application decision (n=20)	18.9[16]
Full tariff guarantee Received to Successful Registration (n=1)	21.3[17]
Full tariff guarantee Received and Stage 3 application ongoing (n=11)	32.4

Source: GGSS Application Data, July 2023

[14] Available online https://www.gov.uk/government/statistics/rhi-monthly-deployment-data-march-2023-quarterly-edition

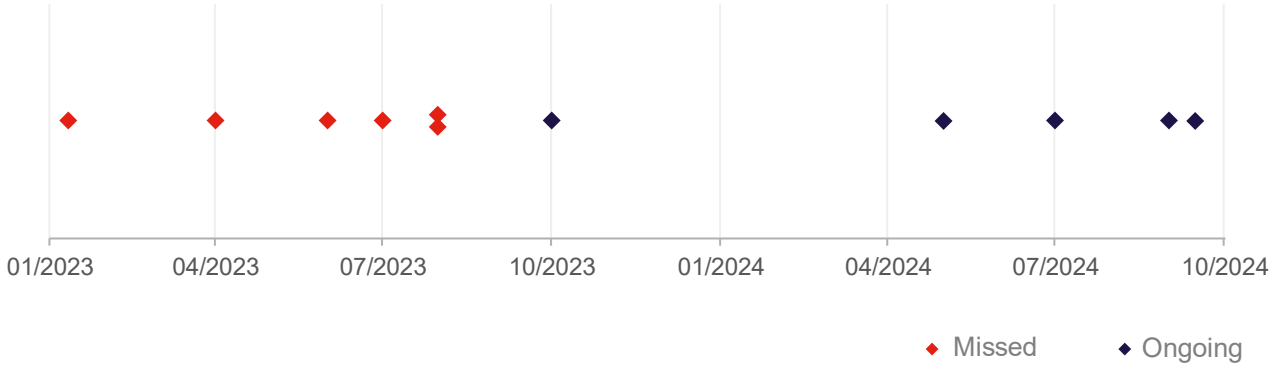
[15] The data received did not provide exact submission dates at each stage, and therefore this analysis is based on the dates in which decisions on applications were made, providing a rough estimate of duration at each stage. The first row measures the duration from initial application to the full tariff guarantee decision. The second two rows measure from when full tariff guarantee was received, to when registration was obtained or for those ongoing, the date at the time of analysis.

[16] This does not include applicants who cancelled applications or had applications revoked.

[17] Sample size of 1.

Figure 14 captures the expected commissioning dates of applicants with full tariff guarantees, showing the extent to which projects are, or are not, on track. Of the 11 applicants at this stage, 6 had not met their expected commissioning date as of 31 July 2023 (shown in red), and only 5 had commissioning dates still in the future (shown in blue). Within the rules of the GGSS, tariff guarantees will only be valid until the date in which applicants stated they would start injecting, with a 182-day grace period. After this period, Ofgem will revoke the tariff guarantee.

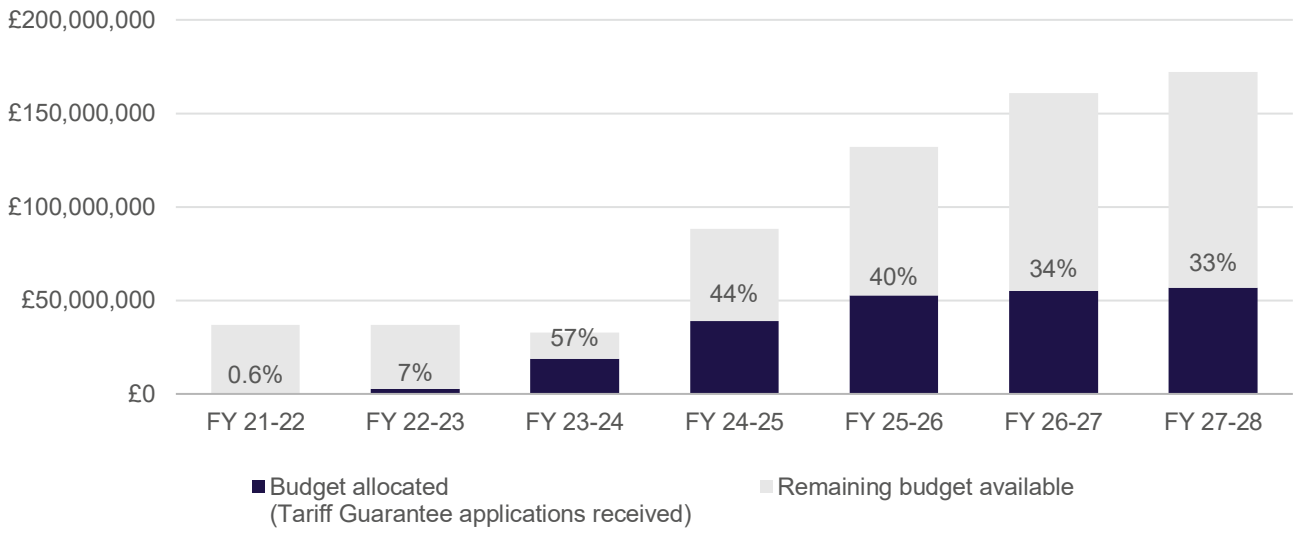
Figure 14: Expected injection start dates for applicants with current (ongoing) applications as of July 2023



Source: GGSS Application Data, July 2023

Figure 15 shows the proportion of the GGSS annual budget cap that has been allocated to GGSS applicants (i.e. those who have applied for full tariff guarantees). As is shown, the GGSS allocated only a small proportion of its annual budget in the first two years of the scheme opening (FY 21/22 and FY 22/23). This is because although there were multiple applicants, few had commissioning dates in the early years of the scheme, meaning budget was not committed for these plants in these years. For the current scheme year, ending in March 2024, over half of the budget has been allocated. This proportion gradually diminishes in consecutive scheme years, to 33% of the £172.3 million budget cap for FY 27/28.

Figure 15: Annual GGSS budget allocated compared to Annual Budget caps, correct as of July 2023



Source: Ofgem Website, 26th September 2023[18]

Plant Size and Biomethane Generation

The GGSS has seen 0.83 million m^3 of biomethane injected in its first seven quarters of operation (year 1 – Q1 year 3). For the ND RHI scheme, during its first full three years, it saw injection levels reaching 3.76 million m^3. This is not a like-for-like comparison, given the GGSS has not completed its third scheme year, but it indicates that to some extent, the GGSS is lagging behind the ND RHI in terms of injection for the equivalent scheme periods. Therefore, despite receiving more early applications, slower commissioning on the GGSS compared to the ND RHI AD plants has meant a lower total injection.

[18] Available online https://www.ofgem.gov.uk/environmental-and-social-schemes/green-gas-support-scheme-and-green-gas-levy/applicants

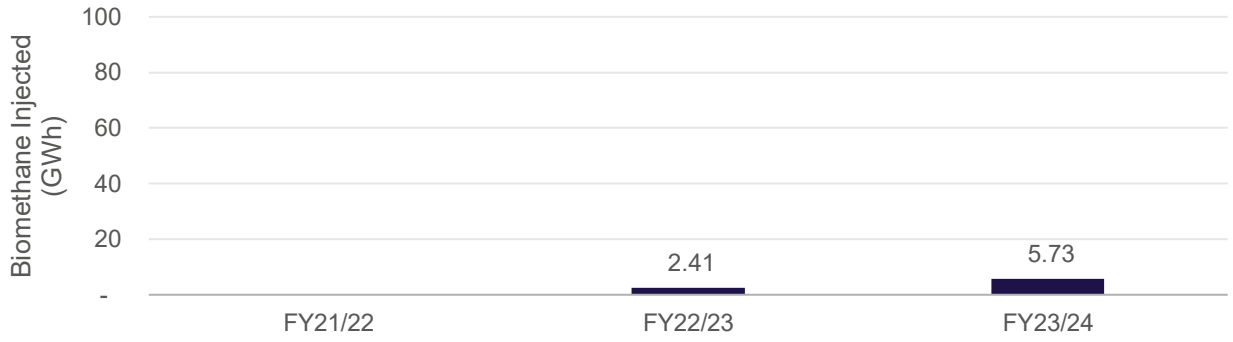
Table 12: GGSS Biomethane Generated / Claimed per year compared to Non-Domestic RHI

Scheme	Year 1 Biomethane Generated / Claimed (m^3)	Year 2 Biomethane Generated / Claimed (m^3)	Year 3 Biomethane Generated / Claimed (m^3)[19]
GGSS	0	246,291.57 m^3	586,840.00 m^3 (Q1 only)
ND RHI	0	475,692.00 m^3	3,284,578.00 m^3

Source: GGSS Annual Report Dataset, July 2023[20]; GGSS quarterly report issue 7; Ofgem (2023) ND RHI Annual Report Scheme Year 12 Dataset[21]

Figure 16 shows the level of biomethane injection achieved by quarter against the estimated central scenario in the GGSS impact assessment. Annual targets have been spread evenly across each quarter. As shown, the level of injection achieved represents 0.60% of the scheme's FY 2022/23 target and 0.64% of the schemes FY 2023/24 target, as of July 2023.

Figure 16: Actual Biomethane Injections (by financial year)



Source: GGSS Annual Report Dataset, July 2023; GGSS quarterly report issue 7[22]

Figure 17 represents the biomethane injection that would have been expected from plants, that have either registered or been awarded full tariff guarantees, based on the stated volumes and commissioning dates provided by plants at the application stage. Due to data availability, the analysis is based on estimates at the application stage and does not take into account where commissioning dates have been missed. Therefore, the analysis in Figure 17 does not reflect actual or anticipated biomethane injection by current applications. These estimates are presented alongside the central and low scenario estimates of biomethane injection from the

[19] Includes Q1 of Year 3 only
[20] Ofgem (2023) Green Gas Support Scheme (GGSS) Annual Report - 2022-23. Available online https://www.ofgem.gov.uk/publications/green-gas-support-scheme-ggss-annual-report-2022-23
[21] Available online https://www.ofgem.gov.uk/publications/non-domestic-renewable-heat-incentive-ndrhi-annual-report-scheme-year-12-2022-23#:~:text=In%20Scheme%20Year%2012%20(SY12,additional%20installations%20to%20the%20scheme.
[22] Ofgem (2023) GGSS quarterly report issue 7. Available online https://www.ofgem.gov.uk/publications/green-gas-support-scheme-ggss-quarterly-report-issue-7

GGSS and GGL Impact Assessment[23], to provide context to the figures (care should be taken when comparing with impact assessment figures which reflect deployment over the lifetime of the scheme). Figure 17 also shows the percentage of the impact assessment central scenario estimated biomethane injection that would have been met by current applicants.

While there is still time for more applications, and for the scheme to achieve similar peak production levels as seen in the IA, the scheme has seen lower than expected applications in the first two years (based on data up to date as of July 2023) achieving applications that represent 3% of expected injection in FY 2022/23, and 30% of expected injection in FY 2023/24. Furthermore, as is shown in Figure 14, most plants included in these estimates that intended to commission in 2023 have missed their commissioning dates, meaning that the actual injection figures are likely to be lower. At present, for FY 2024/25, 38% of the expected injection is met by current applicants, and for peak injection, the scheme is estimated to achieve 36% of the Impact Assessment's central scenario peak injection[24] estimate, from current applications. Although the scheme is still accepting applications, with lead times from initial application to commissioning as long as they have been, there is a risk that applications received after the cut-off date for this analysis (July 2023) will struggle to impact expected injection for 2024. For FY 2023/24 and FY 2024/25 estimated deployment is just below the IA low scenario.

Although it is not within the scope of the evaluation to review the data concerned, we note the Department has updated their estimates of biomethane injection under the GGSS, following the scheme extension announcement. The latest Application Budget Cap estimates increase from £51.7m in 2024/25 to £174.2m in 2027/28[25]. Although the Application Budget Cap estimates are not forecasts of spend, they indicate a level of spend the Department believes to be a realistic possibility. At scheme launch, peak annual GGSS spend was estimated at £150m[26]. Hence these estimates show that, plants are expected to commission later than initially anticipated but biomethane production could exceed impact assessment estimates by FY 2027/28. The need for plants to be able to commission at a later date reflects part of the Department's rationale for extending the GGSS to March 2028, as it should enable expected deployment levels to be met given the current context of supply chain (and feedstock) challenges.

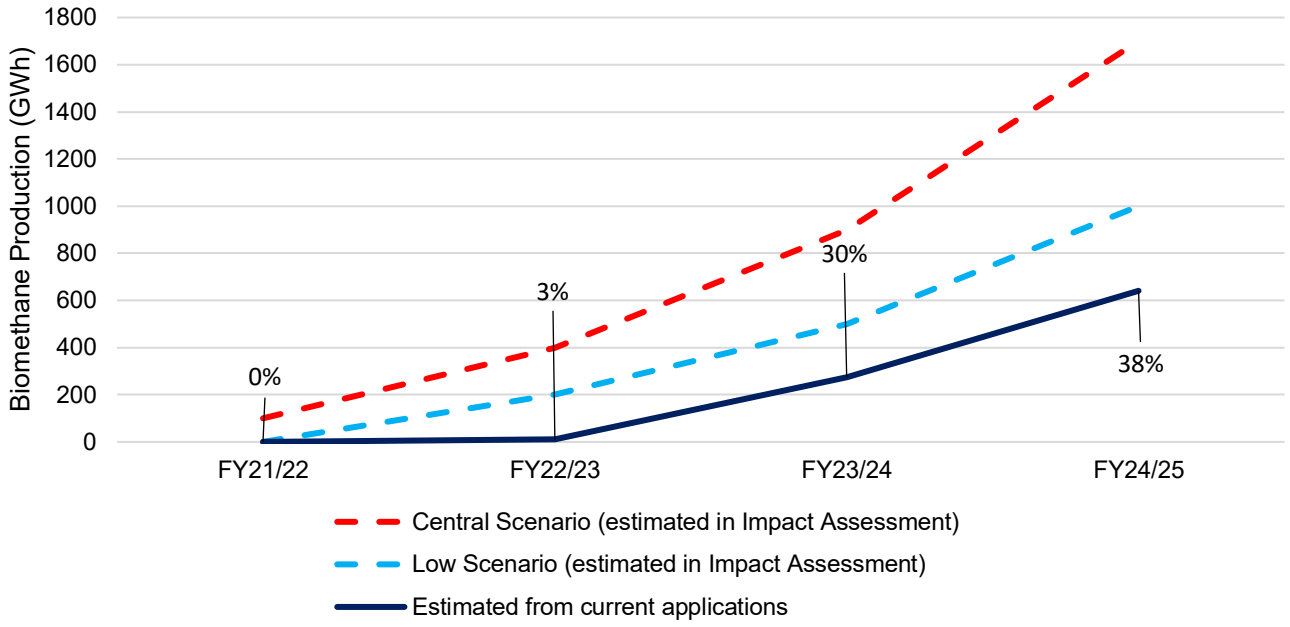
[23] Green Gas Support Scheme and Green Gas Levy: final stage Impact Assessment (2021) available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018133/green-gas-impact-assessment.pdf

[24] Peak injection reflects the point at which no further plants can deploy onto the GGSS and all plants are injecting biomethane at their peak capacity. This level of injection is expected until plants begin to decommission as they reach the end of their operational lifetime. In the GGSS final stage Impact Assessment, peak injection was estimated to occur between 2029/30 and 2040/41.

[25] GGSS budget caps, production factors and inflation forecasts for 2024-25: https://www.gov.uk/government/publications/green-gas-support-scheme-budget-management/ggss-budget-caps-production-factors-and-inflation-forecasts-for-2024-2025

[26] Green Gas Support Scheme and Green Gas Levy: final stage Impact Assessment (2021) available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1018133/green-gas-impact-assessment.pdf. Note that this spend estimate is provided in 2020 prices, whereas Application Budget Cap estimates are provided in nominal terms. Spend was estimated to peak from 2028/29 until 2035/36 at scheme launch.

Figure 17: Expected volume of Eligible Biomethane injected, estimated from Successful or Current Applications

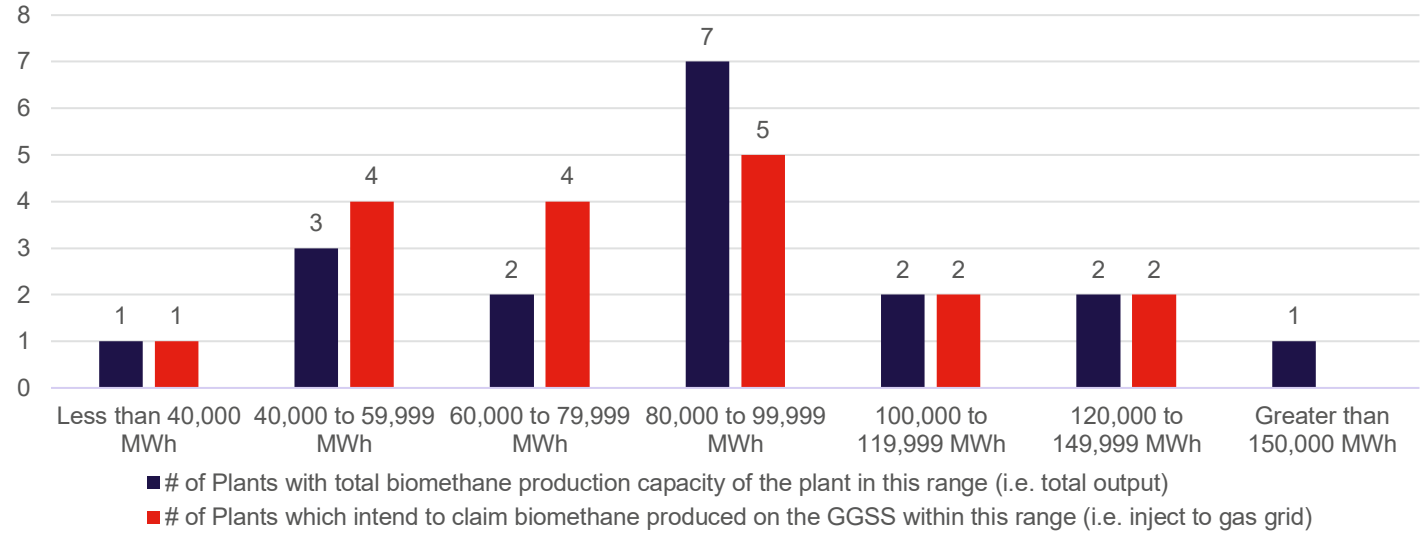


Source: GGSS Application Data, July 2023

Figure 18 below shows the number of applicants by the size of the plant which they proposed to commission in their application, as well as the size band in which they intend to inject as part of the GGSS[27]. In terms of plant size, a greater number of plants have applied at over 80,000 MWh of output compared to less than 80,000 MWh. However, in relation to the expected eligible biomethane to be claimed on the GGSS, half the plants will claim below 80,000 MWh. This difference, discussed more in the main body of the report, is likely down to plants intending to claim biomethane produced through other support schemes and policies, such as the RTFO, rather than solely on the GGSS.

[27] Application forms ask participants to provide the volume of biomethane that the plant will produce and volume of eligible biomethane to be claimed on the scheme.

Figure 18: Applications Received by Plant Size



Source: GGSS Application Data, July 2023

As is shown in Table 13 the average plant size of applicants to the GGSS scheme is equivalent to 89,700 MWh of output, compared to 52,000 MWh on the ND RHI. A two-sample t-Test has been applied to analyse whether these two means are statistically different. The resultant one-tail P value came to 0.000601, and was less than 0.05, and therefore it can be interpreted that there is a statistically significant difference between the means of the plant sizes.

Table 13: GGSS Average Plant Size compared to Non-Domestic RHI Plants

Scheme	Average Plant Size (MWh)	Sample
GGSS	89,700 MWh	18
ND RHI	52,000 MWh	170

Source: GGSS Application Data, July 2023; Data request to DESNZ for ND RHI data.

Green Gas Levy

Green Gas Levy Suppliers, Collection and Dispersal

The Green Gas Levy has had between 85 and 98 gas suppliers active on the scheme. Suppliers have only been required to make quarterly levy payments from Year 2 of the scheme (April 2022) onwards. In year two, one supplier was provisionally exempt (meaning at least 95% of its gas supply was expected to be certified biomethane). In year one, no suppliers were provisionally exempt given that no payments were required from suppliers. For the first quarter of year 3 (FY 2023/24) there are 87 registered suppliers and one provisional exemption.

Table 14: Green Gas Levy Scheme Suppliers

Scheme Year/Quarter	No. of Scheme Suppliers	No. of Provisionally Exempt Suppliers[28]
Q3 Year 1 (Nov – Dec 2021)	85	N/A
Q4 Year 1 (Jan – Mar 2022)	98	N/A
Q1 Year 2 (Apr – Jun 2022)	94	1
Q2 Year 2 (Jul – Sept 2022)	91	1
Q3 Year 2 (Oct – Dec 2022)	90	1
Q4 Year 2 (Jan – Mar 2023)	88	1
Q1 Year 3 (Apr – Jun 2023)	87	1

Source: GGSS Annual Report Dataset, July 2023

The GGL levy rate is set annually for each scheme year (starting the 1 April), by the 31 December the preceding year, and is based on a range of variables including the projected GGSS scheme expenditure, forecast year end surplus (underspend on the GGSS), Ofgem administration costs, and desired headroom amount. Levy rates for the first three scheme years are shown in Table 15 below.

Table 15: Levy Rate

Scheme Year	Levy Rate per meter per day	Levy Rate per meter per period
Year 1	0.484p per meter per day	59p per meter over the period
Year 2	0.576p per meter per day	£2.10 per meter over the period
Year 3	0.122p per meter per day	45p per meter over the period

Source: Department for Energy Security and Net Zero, December 2022[29]

Table 16 shows the proportion of levy funds that have been collected which have been distributed to GGSS biomethane produces. Of the Year 2 levy Collected (there was no levy collected in the first year of the scheme) only 0.19% has been used to pay for biomethane injection. Data for the first quarter of scheme Year 3, 1.77% of Q1 levy funds have been

[28] For Q3 and Q4 in Year 1 of the scheme, no levy payments were required hence no suppliers were exempt from paying the levy.
[29] Department for Energy Security and Net Zero (2022), Green Gas Levy (GGL): rates, underlying variables, mutualisation threshold for the 2023-2024 financial year.

dispersed to GGSS plants. This means to date, of the £66.9 million collected from gas suppliers, less than half a percentage of this has been used to fund biomethane production.

Table 16: Funds Received from the GGL and Dispersed on the GGSS

Year	Total Levy Collected	Funds Dispersed on GGSS (£)	Funds Dispersed on GGSS (%)
Year 1	N/A	£0	N/A
Year 2	£53,953,882.28	£104,860.84	0.19%
Year 3[30]	£12,923,645.02	£228,414.58	1.77%
Total	**£66,877,527.30**	**£333,275.42**	**0.498%**

Source: GGSS quarterly report issue 7, July 2023

The levy is also used to fund the costs to Ofgem of administering the GGSS and GGL. In Year 1 and 2, Ofgem's forecasted cost of administration was £2.66 million, with £1.45 million spent on development and set-up project costs. Costs for Year 3 are forecast to exceed £3 million.

Table 17: Ofgem Administration Costs

Ofgem Administration Costs	Total (£)[31]
Year 1 Administrative Costs (Nov 2021 – Mar 2022)	-
Year 2 Administrative Costs (Apr 2022 – Mar 2023)	£2,656,000.00
Forecast Year 3 Administrative Costs (Apr 2023 – Mar 2024)	£3,080,000.00

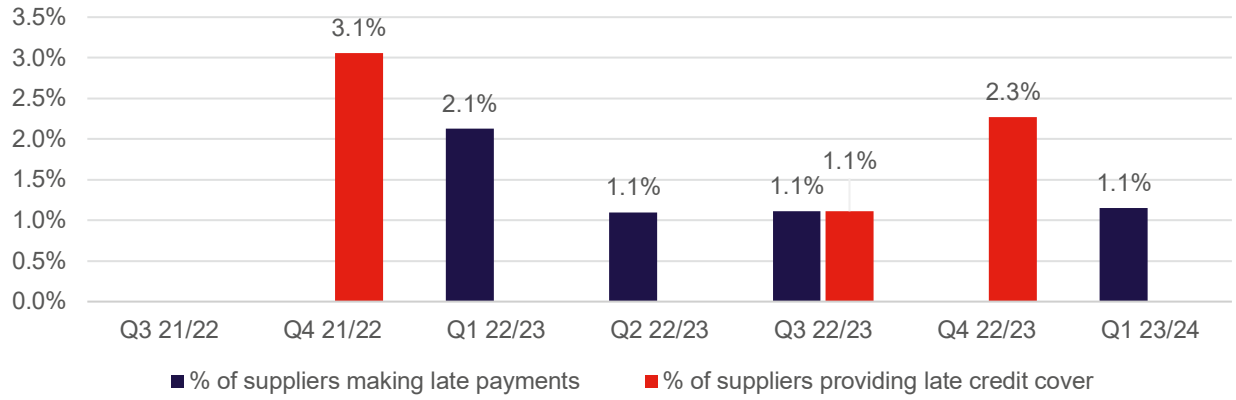
Source: Department for Energy Security and Net Zero, December 2022[32]; Forecast costs provided by the Department for Energy Security and Net Zero as part of data request.

Green Gas Levy Supplier Non-Compliance

As recorded in Figure 19, instances of non-compliance across the Green Gas Levy have been minor, with the largest instance of non-compliance impacting just over 3% of suppliers (3 suppliers provided late credit cover) which happened in the first instance of credit cover requests, where some teething issues are to be expected. Late payments have occurred with a small proportion of suppliers in all quarters but one, where payment was requested (i.e. Year 2 onwards. No payment was requested in scheme Year 1).

[30] Includes Q1 of year 3 only.
[31] Year 1 administrative costs are displayed as £0 as year 1 and 2 costs were collected together.
[32] Department for Energy Security and Net Zero (2022), Green Gas Levy (GGL): rates, underlying variables, mutualisation threshold for the 2023-2024 financial year.

Figure 19: Proportion of Suppliers not compliant with payment or credit cover deadlines



Source: GGSS Annual Report Dataset, July 2023; GGSS quarterly report issue 7, July 2023

Years 1 to 3 of the levy saw thirteen instances of statutory non-compliance (meaning late payments or credit cover lodgement). In all cases, this represented very minor delays in making payments, with an average of 1.92 days late across late payments and late credit cover, shown in Table 18.

Table 18: Instances of non-compliance and length of delays

Type of Non-Compliance	Instances of non-compliance (total)	Average Length of Delays (days)
Late Levy Payment	7	1.86[33]
Late Provision of Credit Cover	6	2.00
All types of non-compliance	**13**	**1.92**

Source: Ofgem GGL default register, August 2023[34]

Given the limited instances of non-compliance, and the low number of days in which it took to resolve non-compliance, there have been no instances of either suppliers having credit cover drawn down, nor Ofgem running mutualisation exercises to cover levy under-collection.

Table 19: Green Gas Levy compliance regime

Green Gas Levy Compliance Regime	No. of Incidents
Credit Cover draw down	0
Mutualisation Exercises	0

Source: Ofgem GGL default register, August 2023

[33] One supplier who was recorded as a late payment had their gas license revoked as they had ceased to supply gas to all customers, and therefore did not provide payment and were removed from the analysis of average length of delays.
[34] Available online https://www.ofgem.gov.uk/publications/green-gas-levy-default-register

Annex 7: Survey Analysis

Introduction

The purpose of the pulse survey is to provide longitudinal data on Green Gas Support Scheme (GGSS) participants and applicants alongside participants to the Non-Domestic Renewable Heat Incentive (ND RHI) as contextual evidence on the biomethane sector for the evaluation. The current survey sought to capture operational data for the financial year 2022/23. In total, 13 responses were received.

Based on the number of responses received and the detail of those responses, it is too early to say whether the GGSS has contributed to an increase in the scale, operational capacity and performance of the biomethane sector. There are three core reasons why the data are restricted at this stage, which are discussed in the main body of the report. These are:

1. The small scale of the GGSS and ND RHI biomethane plant populations.

2. The fact that many plants are not yet operational on the GGSS.

3. That due to incomplete contact information, it was challenging to identify and engage personnel with responsibility for operations on some sites. This was often because data received was for the lead investor or business, rather than individual site managers.

Summary of findings

This section provides a summary of the findings from the survey that are relevant for the process questions reflected on in the Annual Interim Report.

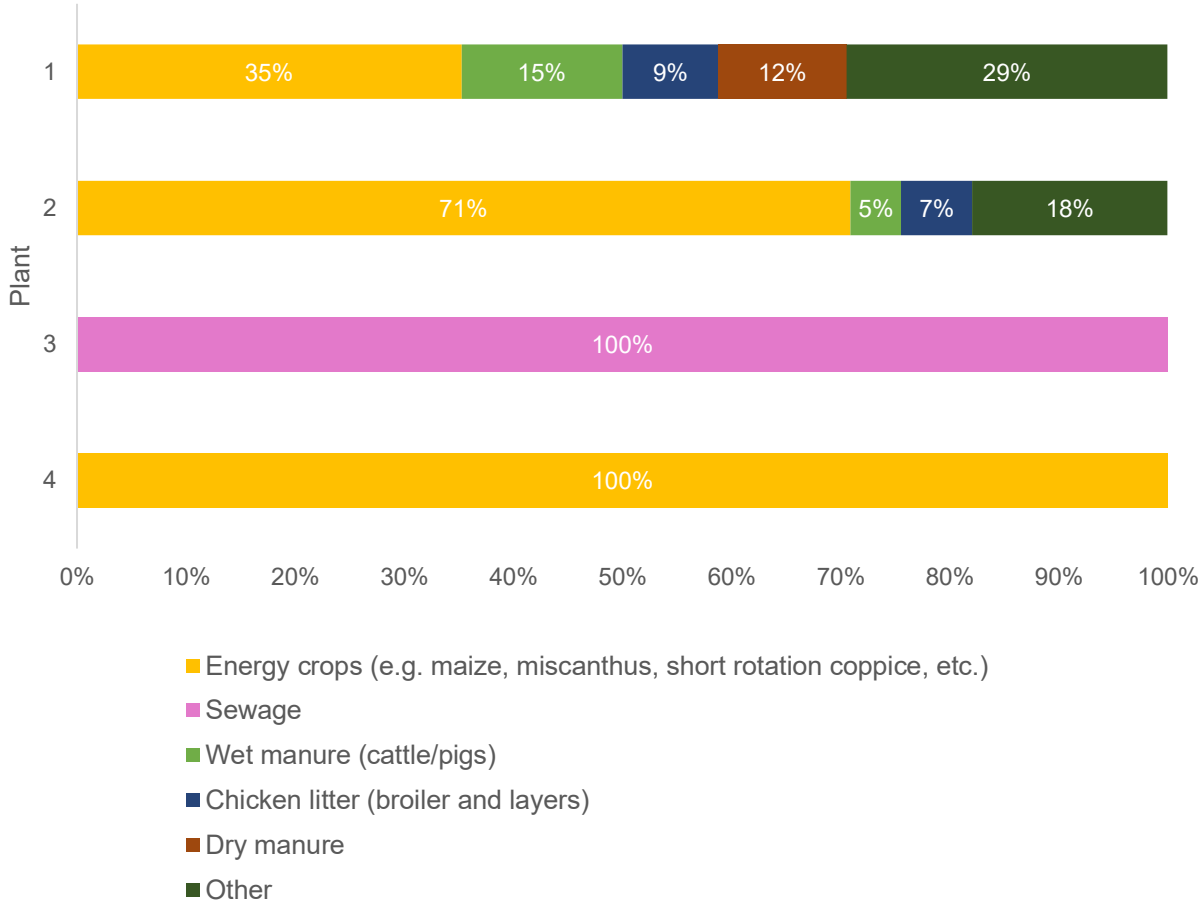
It is too early to describe the typical feedstock mix of biomethane plants deployed under the scheme.

Two GGSS applicant plants (with applications ongoing) were operating at their maximum capacity in 2022/23 using a mix of feedstock types[35], largely energy crops, with some wet manure, food waste collected by local authority and 'other' (one clarified this as beet pulp). The feedstock mix for these two plants is depicted in the top two bars of Figure 20 below.

Two ND RHI recipients provided data on their feedstock types for 2022/23, with one reporting 100% sewage and one reporting 100% energy crops, shown in the bottom two bars of the Figure 20 below. There was sufficient data for one ND RHI recipient to determine they were operating at maximum capacity.

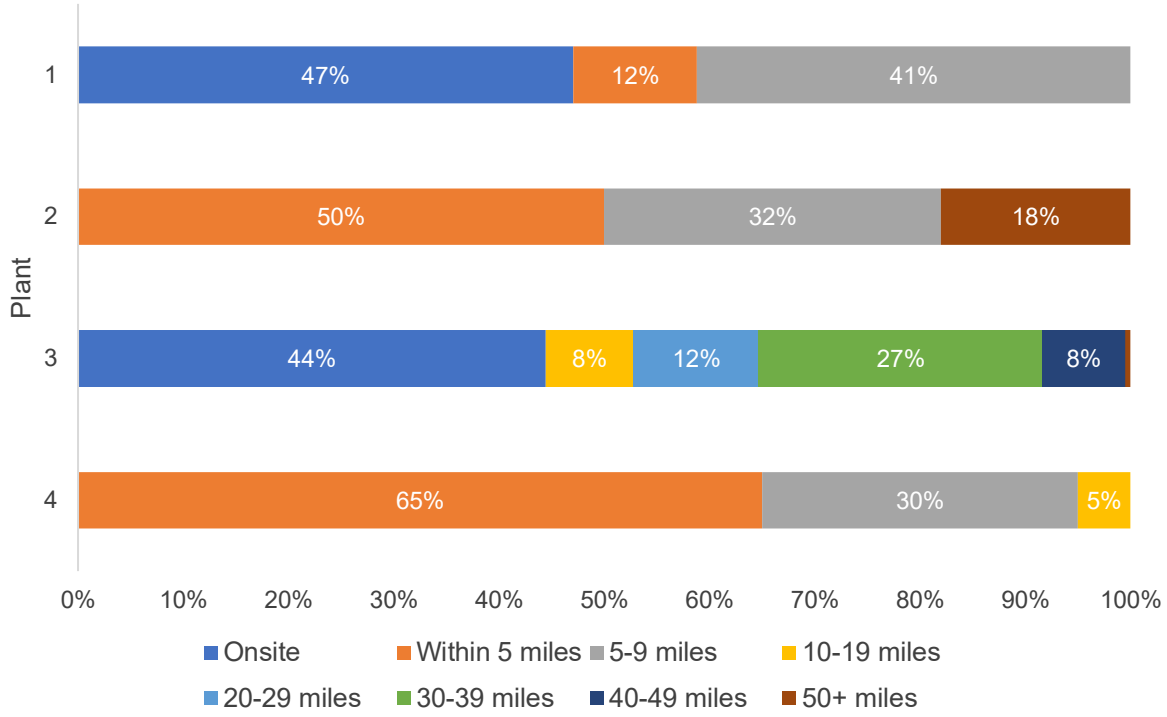
[35]They did not provide details of their biomethane generation capacity or quantity of digestate produced. It has not been possible to confirm with these respondents what their feedstock capacity and feedstock volumes processed relate to - no further detail was provided by respondents in their online survey response and despite reaching out to the respondents by telephone and email to try and clarify, this was not possible.

Figure 20: Percentage of the total feedstock mix (tonnage) for responding AD plants (case by case)



For the 4 respondents that provided feedstock data, almost one third (30%) of their aggregated feedstock is generated onsite, and the majority of the remaining feedstock is sourced within nine miles of the site. Figure 21 below shows the geographic distribution of feedstock sourcing for each of the four respondents that provided data.

Figure 21: Geographic distribution of total feedstock (tonnage) for responding AD plants, case by case



Policies and certification

Early data suggests other policies are not influencing the scale and nature of AD deployment amongst GGSS applicants.

With regards to certification, 2 ND RHI recipients were certified by the RGGO. No respondents said they were producing RTFO certified biomethane.

Beyond certification, GGSS applicants are not participating in other policies (or schemes such as RGGO, which is not a government policy), whereas ND RHI applicants are participating in the RO (one participant) and the Feed in Tariff (FIT) (one participant). Table 20 below shows the number of respondents participating in other policies.

Table 20: Participation of AD plants in other policies (n=4)

	GGSS applicants	**ND** RHI recipients
RTFO	0	0
Feed in Tariff (FIT)	0	1
Renewables Obligation	0	1
Contracts for Difference (CfD)	0	0

Annex 8: Green Gas Support Scheme (GGSS) & Green Gas Levy (GGL) Literature Review

Introduction

This literature review focuses on the market, technical, regulatory, and policy context of the GGSS and GGL, scheme and levy processes, and stakeholders. The purpose of the document is to provide context regarding why the GGSS was created, how it fits into the UK decarbonisation roadmap, and how the GGSS evolved from the Renewable Heat Incentive. The mechanisms by which the GGL funds the GGSS are also detailed.

UK Decarbonisation

The UK has a legally binding target to reduce Greenhouse Gas (GHG) emissions to net zero by 2050. In 2021, territorial emissions were 426.5 $MtCO_2e$,[36] 5.3% lower than pre-Covid levels and down 47.6% on 1990. This has been driven in large part by reducing CO_2 emissions from power stations, as generation has shifted away from coal towards natural gas and renewables.

Decarbonising the gas grid

In 2021, emissions from the residential sector accounted for 16% of UK GHG emissions [36]. Residential GHG emissions are predominantly CO_2 (97%), the main source of which is the combustion of natural gas for heating and cooking (318.4 TWh[37]). Electrification is an important option for decarbonising the domestic sector - boilers are replaced with heat pumps, and gas ovens and hobs with electric equivalents. In this way an electrified property can be completely removed from the gas grid. However, there are challenges in retrofitting all properties across the UK in terms of cost.

Natural gas combustion also contributes to the GHG emissions of the commercial and industrial sectors, again much of this fuel being used for heat generation (199.5 TWh[38]). The industrial sector in particular requires large quantities of high temperature process heat. Industrial processes tend to utilise the economy of scale and hence operate with large throughput, furthermore they often require steam or direct firing to drive the system. At present, these kind of heat demands cannot be easily provided via an electrified heating system, such as high temperature heat pumps, resistive heating, electromagnetic heating, and arc furnaces. Heat pumps operate with lower efficiencies at high temperatures, though strong developments

[36] BEIS, 2021. *2021 UK Greenhouse Gas Emissions, Final Figures.*
[37] BEIS, 2022. *Digest of United Kingdom Energy Statistics 2022, Chapter 4 Natural Gas.*
[38] BEIS, 2022. *Digest of United Kingdom Energy Statistics 2022, Chapter 4 Natural Gas. Value equals sum of: Iron & Steel, Other Industry, Other Final Customers, Manufacture of synthetic coke oven gas.*

are being made in this area. Furthermore, the high cost of electricity compared to fossil fuels often makes the financials of electric systems unfavourable.[39]

The decarbonisation of the gas grid is therefore likely to play a key role in decarbonising heat in the UK. The gas grid can be decarbonised by replacing natural gas with low carbon gases which include hydrogen and biomethane. In order to understand the benefits and limitations of biomethane, we must consider both gases within the context of nationwide decarbonisation.

Hydrogen:

Hydrogen can be generated in several ways. For example, blue hydrogen is generated from natural gas via steam methane reforming (SMR) or autothermal reforming (ATR) combined with carbon capture and storage (CCS). Green hydrogen is generated via the electrolysis of water using renewable electricity (e.g. solar or wind). In this way, the only products generated are hydrogen and oxygen, both of which have commercial value. The Government will take strategic decisions on the role of hydrogen in heating in 2026, which will determine the long-term development of hydrogen transport and storage infrastructure beyond industrial hydrogen applications. While the case for widescale deployment of hydrogen infrastructure in the UK is being considered, biomethane generated from anaerobic digestion facilities has and will continue to decarbonise the grid.

Biomethane:

Biomethane (frequently referred to as green gas) is methane derived from organic feedstocks, which are often of renewable origin. Most often this green gas is generated from anaerobic digestion (AD). In short, organic matter is decomposed within the AD reactor, generating biogas that requires processing before it is then enriched with propane to produce biomethane. Typically, this biomethane is injected directly into the gas grid, though it can also be bottled and sold directly to customers. Put simply, for each unit of green gas injected into the grid, one less unit of natural gas is needed (assuming demand for gas remains constant). The end consumer does not notice any difference in the gas they obtain from the grid, nor do they need to modify their existing equipment.

$$\boldsymbol{Organic\ matter \rightarrow AD\ reactor \rightarrow Biogas\ Upgrading \rightarrow Injected\ into\ gas\ grid}$$

Biomethane is derived from organic matter, and so the carbon emissions released once the gas is ultimately burnt are biogenic. In the instance of crop-based feedstocks, the CO2 released during combustion is equal to the CO2 the plants absorbed during growth. Since AD only utilises non-woody organic matter (not trees), the CO2 cycle between growth and combustion is short. This gives confidence to the carbon neutrality of green gas. Of course, there are other life cycle emissions associated with green gas generation and use, but this will be detailed in a later section. Under the GGSS, the biomethane injected must have a carbon intensity less than or equal to 24 gCO2/MJ (averaged across all feedstocks).

[39] Ambienta, 2023. *Electrifying Industrial Heat: A Trillion Euro Opportunity Hiding in Plain Sight.*

Green gas has the potential to abate emissions across the whole value chain without the need for large scale changes. The deployment of biomethane to replace fossil fuels does not require substantial investments in new infrastructure, and biomethane is easily stored and produced at a constant pace. Methane can be liquified at high temperatures and lower pressures than hydrogen. Furthermore, the consumption of biomethane via the gas grid does not require behavioural changes for the consumer, unlike heat pumps which requires modifying the heating system. Even the consumption of pure hydrogen via the gas grid may require modifications to the heat generation system, for example natural gas reciprocating engines can be run on pure hydrogen but they commonly need to be modified to accommodate the new combustion conditions. Biomethane production combined with carbon capture, utilisation and storage (CCUS) offers the great potential of achieving negative emissions and greenhouse gas removal targets in the UK. Future Biogas, for example are planning to retrofit many of their current biomethane installations in the UK and equip new ones with CCUS, with the captured CO2 transported for permanent storage in the Northern Lights Project.[40]

The limitation of green gas comes from considering the magnitude of natural gas consumption in the UK, as expanded upon in Section 0. The scale of emissions reduction potential from biomethane is limited by feedstock availability, the prioritisation of its use across the economy, life-cycle emissions from production and sustainability requirements. For these reasons, biomethane is not considered a stand-alone solution for heat decarbonisation. However, biomethane is likely to have a valuable role to play across all heat decarbonisation pathways.

Anaerobic Digestion & Biomethane Injection

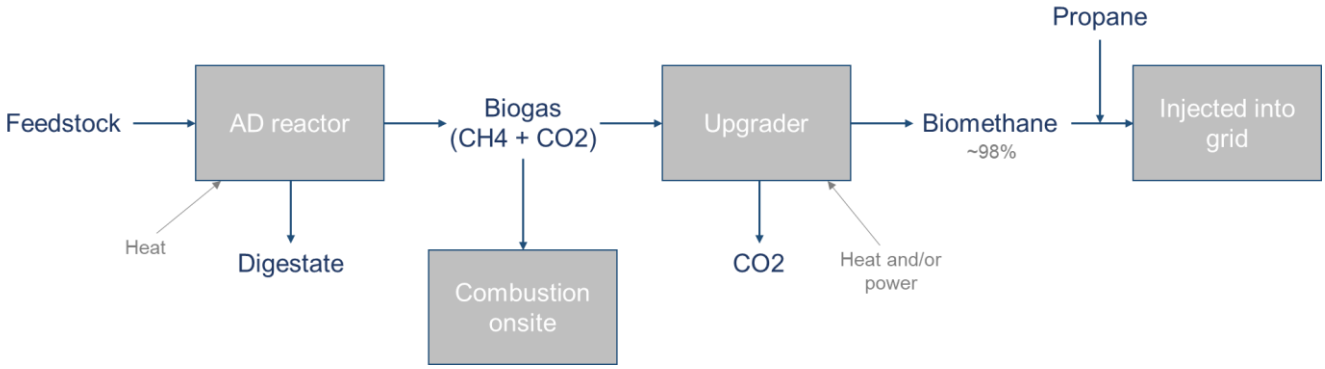
Anaerobic digestion utilises microbes to breakdown organic matter into methane. Feedstocks to AD can be broadly split into three categories: products, residues, and wastes. But fundamentally all feedstocks are similar in the sense that they are non-woody, have a fairly high moisture content and a moderate energy density. The feedstocks are added to the AD reactor in which there is a cocktail of microbes. A cascading series of biochemical reactions take place in which the complex organic compounds that make up the feedstock are broken down into biogas and digestate. Biogas is a mixture of methane and carbon dioxide, whilst digestate often has value as an organic fertiliser. A portion of the biogas is often combusted to meet on-site power and/or heat requirements, and for biomethane production the remainder is sent to a biogas upgrader, where the methane is separated from the carbon dioxide. Following the addition of a small amount of propane and an odorant, this isolated biomethane is then injected into the gas grid or stored and used to replace other natural gas end uses.

The AD process requires heat at 38°C for mesophilic and around 56°C for thermophilic processes.[41] This heat is typically provided via a dedicated biogas CHP or boiler onsite. The biogas upgrade process is also energy intensive, requiring both heat and electricity with membrane and water wash processes requiring large amounts of electricity (for compression, up to 19 bar for membrane systems and 6-7 bar for water wash) and chemical absorption processes requiring large amounts of heat (typically low-pressure steam at 3 bar). These additional energy requirements as well as the life cycle emissions

[40] Bioenergy Insight, 2021. *Future Biogas to Build 25 New Plants with CCS.* Accessed: 25.10.2023.
[41] Mesophilic: bacterial growth at moderate temperature. Thermophilic: bacterial growth at high temperatures.

associated with the feedstock life cycle and methane fugitive emissions (methane leakage) from onsite operations should be taken into account when estimating the GHG savings associated with biomethane production and injection.

Figure 22: Simplified block flow diagram of the biomethane production process



Feedstocks

Under Ofgem's requirements, feedstocks are categorised into products/co-products, residues, and wastes.[42] A feedstock is a product if its creation was the primary objective of the producer. Examples of products include wheat and rye crops. When a farmer grows wheat, it is their objective to yield as much wheat as possible, and hence it is a product. Products typically have a higher energy density, but if they are a primary biofuel then they lead to direct competition for food supply.

A feedstock is a residue if its creation was not the primary objective of the producer.[43] Straw is an example of a residue. When a farmer grows a crop, it is their objective to maximise the quantity of crop produced, not the quantity of straw leftover. Straw is therefore a residue. The use of residues as a feedstock does not lead to competition with food supply, though these residues do typically have a financial value. For example, straw can be used in AD or as animal bedding.

A feedstock is a waste if the holder intends to, or is required to, discard it. Supermarket food waste is an example of waste. The use of waste in AD is widely seen as a positive because it would otherwise be sent to landfill where limited value can be extracted from it and emissions produced as the waste biodegrades can be avoided.

AD operators typically use a mixture of different feedstocks and feedstock types. However, under the GGSS, sites are being directed away from using products, as will be discussed in a later section. The quantity of methane that can be generated varies by feedstock; some examples are presented in Table 21.

[42] Ofgem (2022). *Green Gas Support Scheme Guidance.* Accessed: 25.10.2023.
[43] Ofgem, 2022. *Green Gas Support Scheme.* Accessed: 25.10.2023.

Table 21: Typical biomethane yields by feedstock [44] [45] [46] [47] [48]

Feedstock	Biomethane yield [Sm^3 CH_4 / tonne volatile solids]
Industrial waste	360
Commercial food waste	333
Primary sludge[49]	315-400
Grass silage	274
Maize	267
Dairy Manure	240
Corn	220
Wheat	210
Domestic food waste	207
Wheat Straw	200
Secondary sludge	190-240
Cattle Slurry	105

Anaerobic digestion

Methane is not formed under aerobic conditions. It is only in the absence of oxygen that methane is formed. In an AD reactor the feedstock and a cocktail of microbes are combined under anaerobic conditions. The AD process can be broadly considered in two steps:

[44] Ofgem, 2022, *Non-Domestic RHI, GGSS and FIT Biogas and Biomethane Apportioning Tool.*
[45] University of Udine, Organic Matter Characteristics and BMP Results of Selected Digester Substrates.
[46] Environ Technol. Enhancement of methane yield from wheat straw, miscanthus and willow using aqueous ammonia soaking.
[47] Bioresource Technology, Microbial population dynamics during start-up of a full-scale anaerobic digester treating industrial food waste in Kyoto eco-energy project.
[48] IEA Bioenergy, 2015. *Sustainable biogas production in municipal wastewater treatment plants.*
[49] Primary sludge ('raw sludge') is produced from gravity settling. Secondary sludge ('excess sludge') is the product of biological waste water treatment.

- In the first step, a group of facultative and anaerobic bacteria convert the complex organic compounds (carbohydrates, lipids, and proteins) into simpler molecules. Carbon dioxide and hydrogen are also formed.
- In the second step, the organics and hydrogen are converted into methane and carbon dioxide by methanogens. This generation of methane allows the bulk of the carbon content to pass from the solid/liquid phase into the gas phase.

The full biochemical pathways are notably more complex than this simple explanation, but such detail is beyond the scope of this report [50].

Upgrading

Biogas from the AD process is a mixture of methane and carbon dioxide, typically 40-60% methane. However, carbon dioxide cannot be injected into the grid and therefore must be removed. This separation is referred to as biogas upgrading. A range of separation technologies are utilised in the sector. Membrane separation, water scrubbing, and chemical scrubbing are among the most widely deployed technologies across the UK. There are benefits and limitations to each of these technologies, though a detailed analysis is beyond the scope of this report. It should be noted, however, that different technologies lead to different purity of the CO_2 produced. The choice of biogas upgrade technology depends on availability of electricity or heat as different processes differ in electricity and heat consumption.

Whilst the biomethane is the primary product, the carbon dioxide isn't necessarily a waste stream from this process, with the correct pre-treatment this CO_2 can be sold for use in other processes. For example, food grade CO_2 can be used in carbonated drinks. Or, the CO_2 can be directed towards long-term storage, in which case the biogenic carbon of the feedstocks is removed from the atmosphere.

Injection to Grid

Once the biomethane has been separated from the carbon dioxide a small amount of propane is often added prior to injection into the gas grid. Typically, natural gas in the grid contains 90% methane and has a calorific value of 39.5 MJ/Sm^3. However, the stream from the upgrader is 98% methane with a calorific value of around 36 MJ/Sm^3. This is too low to inject into the UK grid and must instead meet requirements outlined in the Gas Safety (Management) Regulations 1996[51] which specifies that the Wobble Number (Calorific value divided by the square root of the relative density) must be between 47.20 and 51.41 NJ/m^3. The biomethane is enriched with propane to increase the calorific value[52]. An odorant to give the characteristic 'gas smell' is also added prior to injection for safety reasons.

Externalities of biomethane

The generation of biomethane via AD has both positive and negative externalities. As with all processes, it is important that the constructive impacts are greater than the adverse.

[50] C. Chernicharo, 2007. *Anaerobic reactors.*
[51] UK GOV, 1996. *Gas Safety (Management) Regulations 1996.*
[52] Flogas, 2022. *The propane enrichment of biomethane – the future of energy supply.*

Positive externalities

The positive externalities of biomethane have already been discussed in detail throughout this report. The GHG emissions of biomethane are notably less than that of natural gas. Therefore, the use of biomethane offers a feasible route towards decarbonisation. Furthermore, the uptake of waste as an AD feedstock diverts waste away from landfill. In landfill, the organic matter breaks down under the anaerobic conditions into methane as the addition of further waste prevents oxygen reaching the material below. It therefore follows that methane leaks from landfill are an important source of GHGs that can be avoided with AD.

Negative externalities

At each stage of the AD process there is the potential for methane leakage. The global warming potential (GWP) of methane is 28 times greater than carbon dioxide, and hence these fugitive emissions may not be negligible at all sites.

Sources of methane leakage from biomethane sites may include:

- Fugitive emissions from digesters, pipes, pumps, and other components.
- Fugitive emission from feedstock and digestate storage.
- Methane release from the biogas CHP unit (due to incomplete combustion).
- Methane leakage from the biogas upgrade system.

Research by various organisations worldwide shows that such emissions can be significant[53]. Further research is required to associate specific leakage rates with different types of AD and biomethane plants and onsite operations.

Should a portion of the generated biogas be consumed on site, the direct CO_2 this combustion releases can be considered biogenic, but other greenhouse gases (i.e. the N_2O and the CH_4 not combusted, and hence released) cannot. These latter two gases are a source of air pollution and GHG.

Onsite separation units have the potential to release harmful compounds. For example, if amine-based absorption is utilised, amines are released into the atmosphere within the flue. Amines can degrade into other compounds, most notably N-amines (nitrosamines and nitramines) [54]. Whilst some thermal degradation of the amines does occur within the system, most N-amines are thought to be generated within the atmosphere, post-release. This is a problem because many N-amines are either known or potential carcinogens. It is therefore of great importance that the impacts of these pollutants on air quality are understood and appropriately assessed.

[53] Ricardo, 2023. *Methodology to Assess Methane Leakage from AD Plants*.
[54] AQMAU (2021). *AQMAU recommendations for the assessment and regulation of impacts to air quality from amine-based post-combustion carbon capture plants.*

The Biomethane Market

With an ever-increasing drive to reduce carbon emissions, the biomethane market has been growing in the UK and across Europe. A strong and predictable market is key to sector investment.

Biomethane in Europe

The biomethane market across Europe has been growing year-on-year. There are currently 1,000+ biomethane plants in Europe, with 30 TWh of biomethane injection in 2021.[55] European countries with the highest AD capacity include France, Germany, Denmark, and the UK; however, the feedstock make-up of these countries varies considerably: [56]

- **France:** ~80% agricultural residue.
- **Germany:** ~80% energy crop.
- **Denmark:** ~95% agricultural residue.
- **UK:** ~30% energy crop, ~35% agricultural residue, ~35% organic waste.

It seems likely that biomethane production capacity in Europe will continue to grow for the European Union to meet their binding emission reduction targets, and that agricultural feedstocks will play a key role.

Biomethane in the UK

There were 143 fully accredited sites producing biomethane under the Non-Domestic Renewable Heat Incentive (NDRHI) in the UK in 2022[57], with meaning most biomethane sites in the UK were accredited under the NDRHI. The UK is therefore one of the largest producers of biomethane in Europe.

This success can largely be attributed to government support schemes including the Renewable Heat Incentive. As shown in Figure 23, the number of biomethane sites in the UK has increased from 5 in 2011, to 99 in 2019[58]. Agricultural feedstocks are the most widely used at biomethane sites across the UK 57. It is worth noting that the feedstock criteria under the GGSS are more stringent, with a cap of 50% being placed on the use of products (i.e. at least 50% of the feedstock must be residues or wastes). This cap was only introduced for participants of the NDRHI who applied after May 2018. The bulk of AD sites reside within England, with some in Scotland.

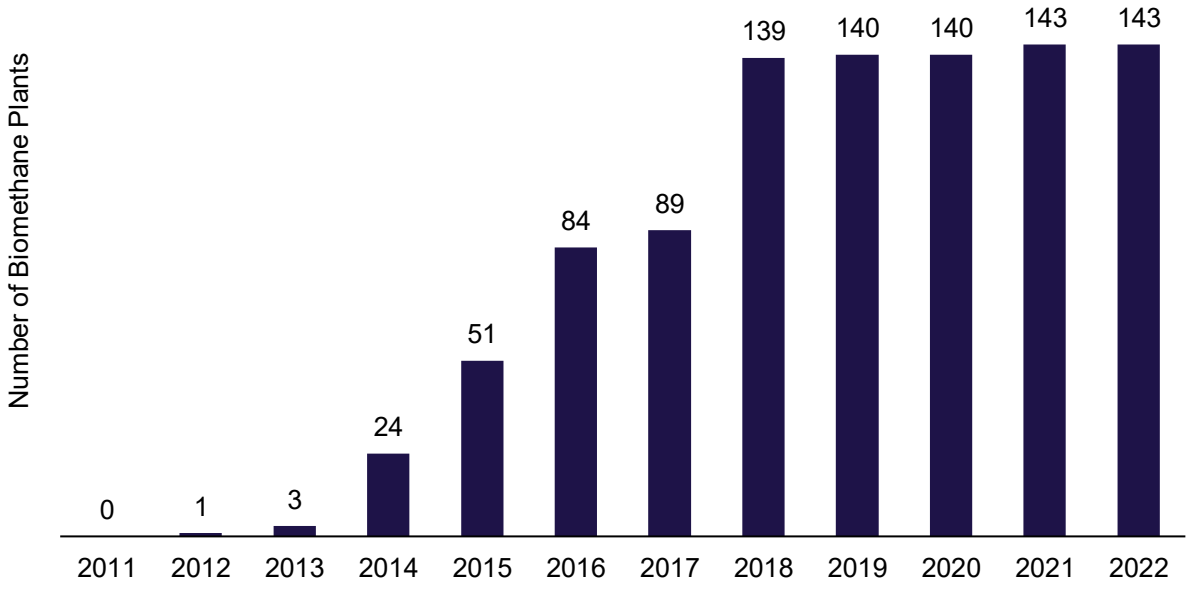
In 2021, the total quantity of biomethane injection increased to 5.9 TWh, with 22% of all biogas generation being directed to grid injection as biomethane (up from 11% in 2016).[59] However, the demand for natural gas in 2021 was 575 TWh (domestic, public, commercial, industrial,

[55] SIAPARTNETS, 2022. *6th European Biomethane Benchmark*. Accessed 25.10.2023.
[56] SIAPARTNERS, 2022. *European Biomethane Benchmark*.
[57] BEIS (2022). *Non-domestic and domestic renewable heat incentive (RHI) monthly deployment data (Great Britain): December 2022.*
[58] It is worth noting that this figure presents the number of biomethane applicants under the Non-Domestic RHI specifically. However, it is likely that near all biomethane injection sites are part of the RHI.
[59] DESNZ (2022). *Digest of UK Energy Statistics Annual Data for UK, 2021.*

transport, losses). Hence, 88 times more gas was consumed by these end-users than biomethane was injected into the grid. As already discussed, biomethane is not considered a stand-alone solution for heat decarbonisation because of the mentioned limiting factors. However, biomethane is likely to have a valuable role to play across all heat decarbonisation pathways. It is also not yet clear if the Biomass Strategy that is to be published will have an impact upon biomethane deployment in the UK.

The Government's Carbon Budget Delivery Plan, published in March 2023, provides an early-stage assessment of 12 TWh/year of potential biomethane injection by 2030.[60]

Figure 23: Number of biomethane sites in the UK [61]



Investment in AD

There is a greater risk when investing in the development of an AD site than with other more established renewables, such as wind and solar. These risks can be considered in two parts, inherent risk, and industry maturity. The GGSS is important to the sector because it provides some market security, guaranteeing a secure source of income from the injected biomethane. This gives greater confidence to AD investors and developers.

Inherent risks of AD:

- The price of feedstocks can be volatile.
- Feedstocks are bulky and hence transport is costly.

[60] DESNZ (2023). *Carbon Budget Delivery Plan.*
[61] DESNZ, 2023. *RHI Monthly Deployment Data: March 2023 (Quarterly edition).*

- Digestate is a by-product of AD and there is a limited market for it. Therefore, it is common for each site to establish a route for disposal, which will depend on the nature of the feedstock.
- AD is a form of biochemical engineering, a practice which is generally seen as riskier to investors when compared to well established mechanical energy generation.

Market risks:

- Natural gas prices are volatile. High natural gas prices make biomethane more desirable, but low natural gas prices make it less competitive.
- The future role and scale of the gas grid as the UK moves towards Net Zero in 2050 is uncertain. If electrification of heat becomes widespread then use of natural gas (and hence biomethane) for space heating will decline. This could impact long term AD investment decisions.

Industry maturity risks:

- AD sites have been injecting biomethane into the gas grid in the UK for less than 10 years. Compared to other countries in Europe, e.g. Germany, Ricardo observes that there is potential for improvement with regard to commercial routes to engineering, procurement, and construction.
- There is a limited number of experienced operating contractors.

Renewable Heat Incentive Scheme (RHI)

The purpose of the RHI

The GGSS cannot be discussed without first explaining the importance of the non-domestic RHI which opened for applications in 2011. Applicants had to provide evidence of commissioning and demonstrate the ability to inject biomethane to be registered. Despite closing to new applicants in March 2021, biomethane sites which had already secured tariff guarantees were given successive extensions to March 2022 initially, followed by a further extension to March 2023. These extensions were granted due to lockdowns imposed because of the Covid-19 pandemic and the resulting supply chain issues that continue to persist.

In general, the scheme aimed to incentivise generation of heat from renewable sources and covered solid biomass, heat pump technologies, biogas and biomethane amongst others. The exchequer-funded scheme paid participants per unit of heat generated for 20 years after the date of registration, and involved an initial application process, followed by compliance with ongoing requirements. As of December 2022, the total installed thermal capacity of registered systems, across all technologies, on the RHI was 5.6 GW from 22,500+ applications.[62]

[62] Ofgem, 2022. *RHI Monthly Deployment Data: December 2022 (Annual Edition)*.

AD sites under the RHI

Most anaerobic digestion sites registered on the RHI scheme produce just biogas rather than biomethane. This is largely due to the capital expenditure required to install the additional upgrading plant and the scale of the project required to make biomethane injection economically viable, as well as local proximity to gas network injection points.[63]

Participants must agree on the classification of their feedstocks used to produce biogas with Ofgem during the application process.

They can be classified as either products, residues, or waste. Products require full life cycle emissions reporting, residues require reporting from the point of collection, and wastes have no associated emissions. The participant must be able to demonstrate that the biomethane injected and the heat generated have a carbon intensity less than 34.8g CO_2e per MJ per consignment of feedstocks (for products and residues). Useful heat produced by biogas combustion in CHP or boilers is paid at a single rate (in p/kWh) in contrast to the 3-tiered system summarised below for biomethane injection (the rate for plant installed on or after 01/01/2019):

- Tier 1: Up to 40,000 MWh pa – 4.95 p/kWh.
- Tier 2: The next 40,000 MWh pa – 2.92 p/kWh.
- Tier 3: Remaining MWh pa – 2.25 p/kWh.

The initial tariff varies based on the date the application or tariff guarantee was submitted. This tariff then decreases in line with the tiered system once each threshold has been met. Finally, the tariff increases every year in line with inflation.

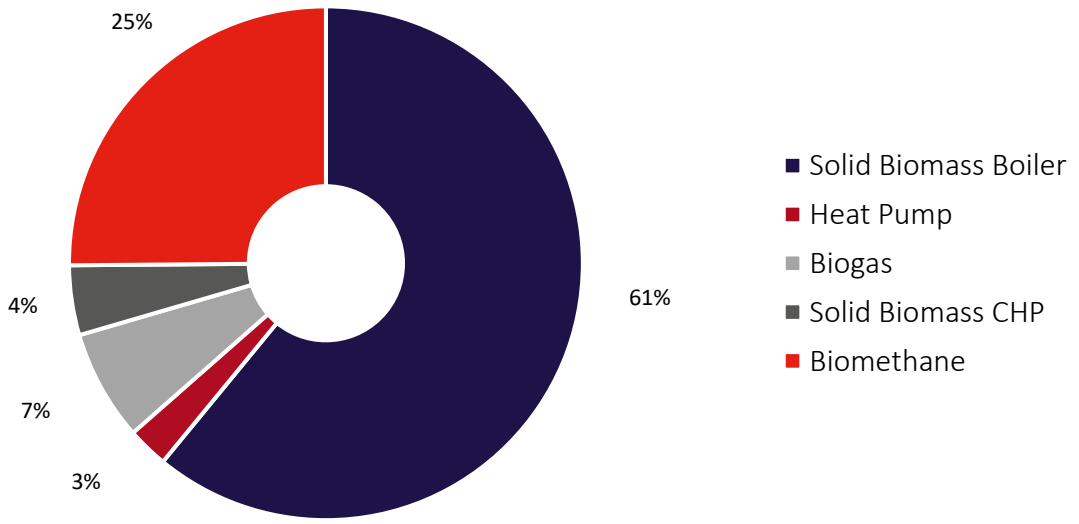
Useful heat is defined as that which meets the definition of heat used for an ‘eligible purpose’. This definition has been updated as regulations changed but in general the heat use must fall under one of 3 categories.

- Space heating within a building.
- Heating domestic hot water within a building.
- Process heating within a building.

Whilst the vast majority of registered sites under the RHI are solid biomass based, biomethane sites account for 25% of the life-time non-domestic RHI heat generated, as illustrated in Figure 24.[64] It can therefore be concluded that support to biomethane sites is a substantial component of the NDRHI.

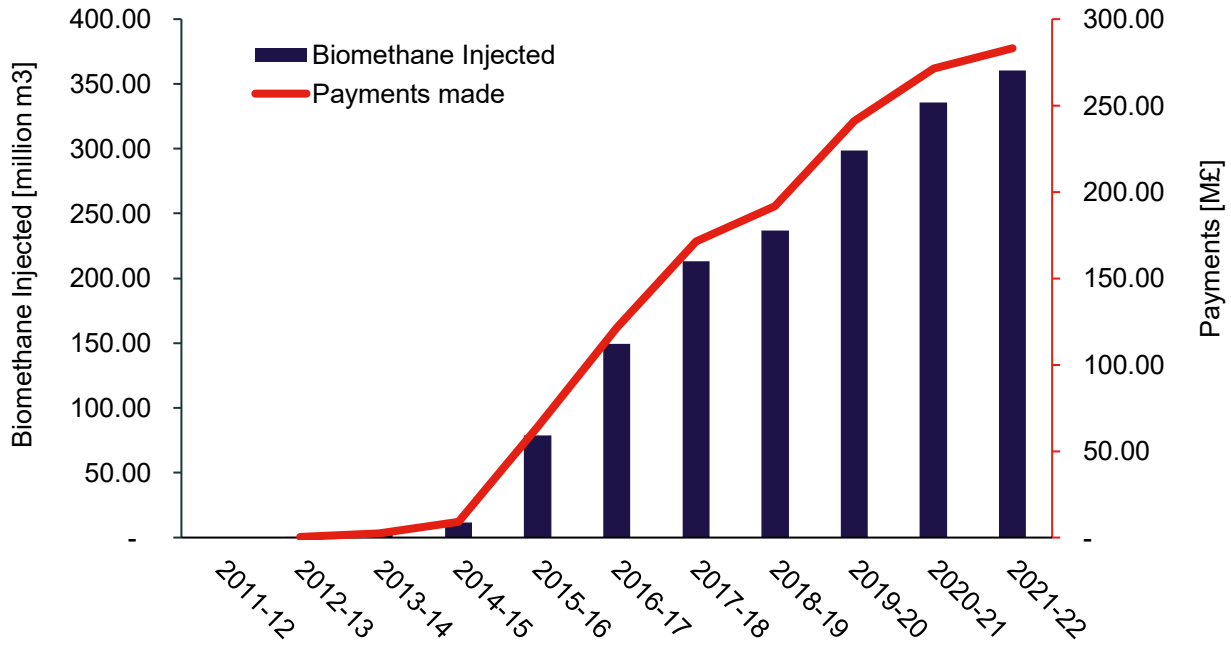
Figure 24: % of total RHI lifetime heat generated - by technology type [65]

[63] Despite most sites being biogas, biomethane contributes a significantly larger volume of energy. Between November 2011 and March 2023, 6,194 GWh of heat produced by biogas was paid for while 22,583 GWh of heat attributed to biomethane was paid for.
[64] Solar thermal and waste have been excluded from the figure as they represent a small portion of the total.
[65] Ofgem, 2022. *NDRHI Annual Report 21-22 Dataset.*



The annual biomethane injected under the RHI, and the resulting payments, are shown in Figure 25. In 2022, £283 million was paid to biomethane site operators.

Figure 25: RHI biomethane - volume of gas injected (Mm^3) and payments made (M£) [66]



The Green Gas Support Scheme (GGSS)

Support for new biomethane sites under the RHI ended in 2021. The Green Gas Support Scheme (GGSS) was opened for submissions on 30 November 2021. The GGSS forms part of

the UK government's strategy to achieve net zero emissions by 2050 [66]. The stated policy aims of the GGSS are to support the development of new AD biomethane plants to produce and inject more biomethane into the gas network and thus reduce carbon emissions by 8.2 million tonnes CO_2e over its lifetime and help decarbonise Great Britain's supplies [67]. It is also anticipated that the Scheme will help create new jobs, especially in rural areas, attract investment into biomethane production and help avoid a market hiatus from closure of the RHI scheme. Ofgem are the authority responsible for the administration of the GGSS programme.

Payments are made to participants every 3 months, for up to 15 years, based on the volume of biomethane that is injected into the grid. The scheme is funded by natural gas suppliers via the Green Gas Levy. The GGSS has a three-tier tariff structure, see values below as of 2023.07.06:

- Tier 1: Up to 60,000 MWh pa – 6.09 p/kWh.
- Tier 2: the next 40,000 MWh pa – 3.90 p/kWh.
- Tier 3: 100,000 MWh to 250,000 MWh pa – 1.72 p/kWh.

[66] The scheme is administered by Ofgem, the participating plants will be paid on the basis of the actual biomethane injected into the gas grid.
[67] Ofgem (2022). *GGSS Annual Report 2021-22 (ofgem.gov.uk).*

Figure 26: Key stakeholders in the GGSS

Requirements and obligations

The GGSS Regulations 2021[68]: and Ofgem's scheme guidance[69] specify the requirements in the application phases, as well as ongoing requirements on scheme participants.

Application requirements include:

- The date on which biomethane injection commenced or is expected to commence.
- The expected maximum initial capacity and expected volume of eligible biomethane to be injected each year.
- The location of the biogas production plant and the injection point.
- A description of the equipment used to produce biomethane.
- Evidence of a connection agreement.
- Evidence that necessary planning permission(s) have been granted.
- Evidence of financial close.
- Estimated project costs.
- Details of feedstocks that will be used.
- Environmental permits.
- Evidence of commissioning equipment used to produce biomethane, including biogas production and conditioning. Equipment must be newly commissioned.

[68] The Green Gas Support Scheme Regulations 2021 (legislation.gov.uk)
[69] https://www.ofgem.gov.uk/publications/green-gas-support-scheme-guidance

- Network Entry Agreement.
- Specification of fuel measurement and sampling (FMS) and reporting.
- Metering requirements.

Ongoing requirements include:

- Equipment used to produce biomethane must be maintained.
- The participant must notify Ofgem within 28 days of making any changes to the installation.
- Account details must be kept up to date.
- Meters must be properly maintained and checked periodically for errors.
- Compliance with digestate requirements.
- Quarterly injection data must be submitted.
- Quarterly sustainability data must be submitted. The participant must evidence that feedstocks meet the sustainability criteria (e.g. 50% cap on use of non-waste feedstocks, GHG emissions no more than 24 gCO_2/MJ) for payments to be made.
- Ongoing compliance with digestate management procedures.
- The participant must comply with any request by Ofgem to audit their installation.

Differences between the RHI & GGSS

The RHI formed the foundation of the GGSS, yet there are distinct differences between the two schemes:

- Under the GGSS, AD sites cannot claim for the heat generated from biogas fired boilers or CHP, as they could under the RHI. The GGSS is designed to only provided benefit for the quantity of biomethane injected, with certain adjustments.
- The carbon intensity threshold for the RHI was 34.8 gCO_2/MJ, this has decreased to 24 gCO_2/MJ with the GGSS. This change tightens the acceptable life cycle emissions of the biomethane generated and encourages use of feedstocks derived from wastes and residues.
- Under the GGSS, participants are no longer required to submit the carbon intensity of each consignment per quarter. Instead, they must provide an average intensity over all consignments.
- Under the GGSS, waste feedstocks are no longer considered emission-less. Instead, they are treated like residues and hence the emissions from transport and any subsequent processing of the waste must be considered.
- Feedstock criteria under the GGSS are more stringent, with a requirement for 50% of feedstocks to be residues or wastes. In this way the GGSS is directing biogas generation away from competing with food supply. This was only introduced for schemes that applied to the NDRHI after May 2018.

- The GGSS has updated the global warming potentials (GWP) it uses to bring it in line with RED II (the RHI used GWPs from RED I). This increases the impact of N_2O and CH_4 emissions under the sustainability reporting.
- The carbon intensity of the biogas must now include the transport & distribution emissions of the biogas, as well as the fuel in use emissions. The combustion of biomethane generates biogenic CO_2, which is not considered, but the CH_4 and N_2O are to be included.
- The GGSS is funded by payments made by licensed gas suppliers under the GGL, whilst the RHI was government funded. These funds are collected by Ofgem, who then distribute them amongst the GGSS accredited sites.
- Under the GGSS, Tier 1 of payment is up to 60,000 MWh pa, whereas under the RHI it was 40,000 MWh pa. GGSS Tier 3 also has an upper limit of 250,000 MWh pa, no upper limit was placed under the RHI. Tariff payments under each tier remain similar between the RHI and GGSS.

The GGSS can be considered an evolution of the RHI. The fundamental mechanisms by which participants claim benefits and report to Ofgem has not changed greatly. However, a number of steps have been taken to further increase the sustainability of biomethane production.

The scheme so far

Table 22 below describes that the GGSS has received 25 applications from AD plants and has guaranteed provisional tariff guarantee to 20 of these applications, and full tariff guarantee to 13. To date (end July 2023), only 1 plant has successfully completed stage 3 of the application process, commissioned their AD plant and registered onto the scheme to begin generating and injecting biomethane to the gas grid.

Table 22: Total Applications Received and Granted [70]

Application Stage	Total Received	Total Granted
Stage 1 (Provisional Tariff Guarantee)	25	20
Stage 2 (Full Tariff Guarantee)	20	13
Stage 3 (Registration)	1	1

Although 25 applications have been received in total, a number of these have been repeat applications from plants that were unsuccessful (encompassing application rejected or withdrawn, tariff guarantee cancelled or revoked) in previous stage 1 or stage 2 applications. 18 individual AD plants have applied to the scheme. 4 of these plants were rejected in stage 1 and did not reapply (and 1 plant rejected at stage 1 did reapply). 7 AD plants were not granted

[70] *GGSS Application Data, July 2023*

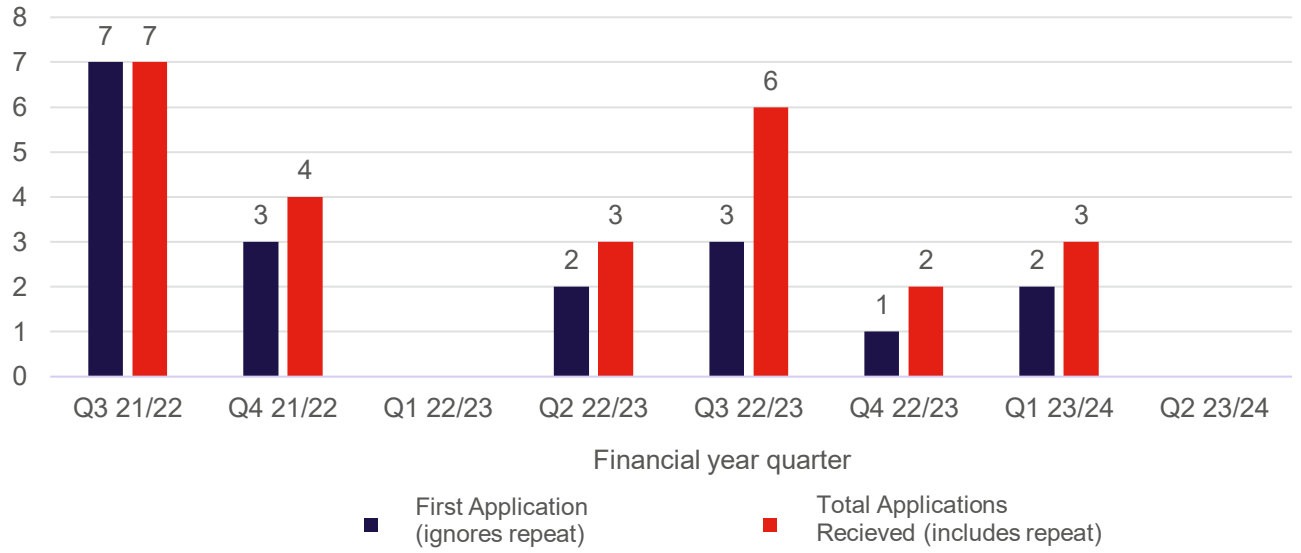
full tariff guarantee, of which, 6 have reapplied and have now received full tariff guarantee (and 1 plant has not yet re-applied following full tariff guarantee application rejection). 12 plants have received their full tariff guarantee and are currently in the process of commissioning their new AD plant to complete their registration to the scheme, and 1 plant has successfully registered.

Table 23: Application Current Status (as of July 2023) [71]

Applicant Status	Total
Rejected Stage 1 (no reapplication)	4
Stage 2 Application Ongoing	0
Rejected Stage 2 (no reapplication)	1
Stage 3 Registration Ongoing	12
Successfully Registered	1
Total Unique Applicants	**18**

Figure 12 shows the timings (by quarter) that applications to the GGSS were received. The graph presents the first time an AD plant submitted their provisional tariff guarantee application (excluding repeat submissions) to show the point in time at which the scheme was reaching applicants, and the total applications received per quarter (including repeat submissions). The first year of the scheme (FY2021/22) saw 10 different AD plants submit applications, with just 6 additional plants applying in FY2022/23. Although data is incomplete for FY2023/24, only 2 new AD plants made applications to the scheme.

Figure 27: GGSS Provisional Tariff Guarantee (Stage 1) Applications Received by Quarter [71]

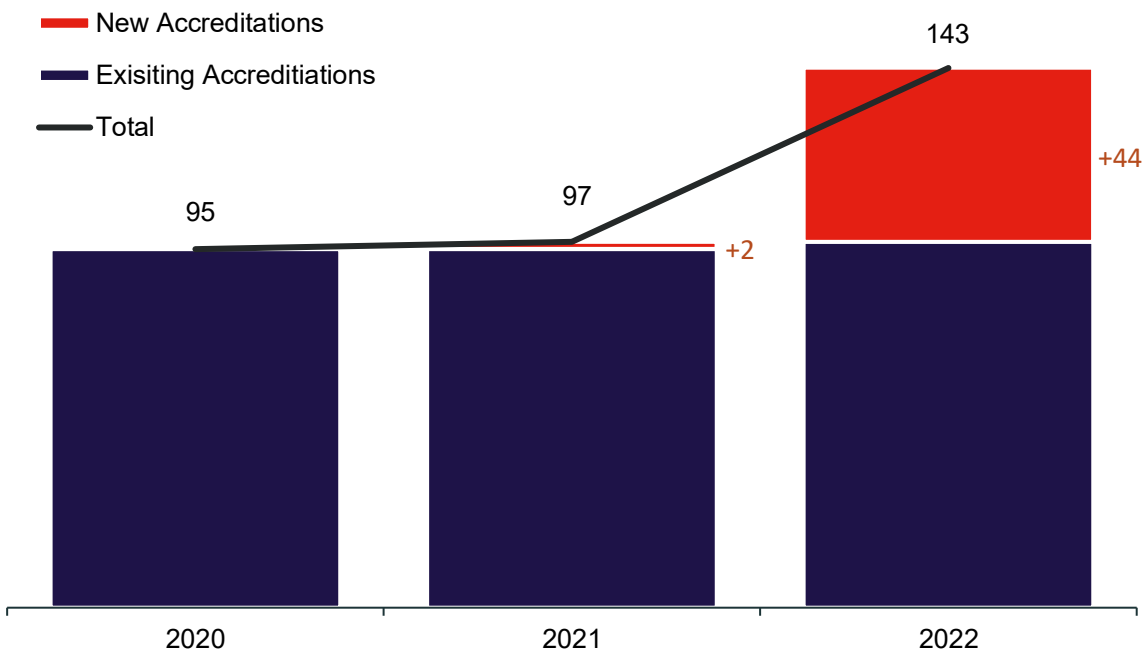


At the time of writing the GGSS has been open to applicants for over one year with one site fully registered, this perhaps indicates a slow start for the Scheme. A potential explanation for this slow start can be found by evaluating the RHI. As shown in Figure 28, the number of biomethane sites registered under the RHI increased rapidly in 2022.[71] An additional 44 sites were registered in this final year of the RHI.[72] It is expected that many sites had RHI applications in the final stages of the registration process and were waiting for further information to be released by Ofgem regarding the GGSS. The value of the biomethane tariffs do not differ greatly between the two schemes, and hence this additional 5 years of payments under the RHI are the financial preference. Biomethane producers also faced supply chain issues and difficulty sourcing the necessary food waste to be used as a feedstock.

The Department for Energy Security & Net Zero have announced that the GGSS will be extended to March 2028.[73]

[71] Please note that Figure 25 shows that there were 99 AD sites in 2019 because the source considered all UK sites, whereas Figure 28 only shows the number of AD sites accredited under the RHI.
[72] For a site to be registered it does not need to be in full operation.
[73] UK GOV, 2023. *GGSS mid-scheme review: extending the scheme (update 21 October 2023)*. Accessed: 25.10.2013

Figure 28: Number of biomethane registrations under the RHI [74]



The Green Gas Levy (GGL)

The Green Gas Levy (GGL) funds the GGSS by placing obligations on licensed fossil fuel gas suppliers to make quarterly levy payments. The payment required by the gas suppliers depends on the number of meters they serve. It is expected that this cost will be passed onto the consumers, though suppliers are not legally obliged to do so. Suppliers who supply 95% or more green gas (certified biomethane produced by anaerobic digestion) within a scheme year are exempt from payment of the levy. As of Q3 2022/23 there are 90 obligated suppliers under the GGL[75], with one supplier being provisionally exempt from payment for 2022/23. It is worth noting that the RHI was government funded, and hence this new mechanism represents a funding shift from exchequer funding.

Gas suppliers must register with Ofgem by setting up an account and providing the requested information. Account registration will allow the supplier to report their meter point data on a quarterly basis. Meter point data is the number of meters served per day for the entire quarter. If a supplier serves 100,000 meters for 45 days of a quarter and 200,000 meters for the full 90 days, their total meter point days can be calculated as per the calculation below:

$$(100{,}000 \times 45) + (200{,}000 \times 90) = 22{,}500{,}000$$

There is a different formula that covers a supplier's first levy payment as a scheme supplier, as a full quarter's meter point data may not be available. Ofgem will provide the supplier with this

[74] This data was compiled from the ND RHI annual reports published by Ofgem: Non-Domestic RHI Annual Reports 2021-22, 2020-21, and 2019-2020.
[75] OFGEM, 2023. *Green Gas Support Scheme Quarterly Report, October to December 2022*

information each quarter so it can be confirmed or challenged by the supplier. If agreed, Ofgem will prepare an invoice. This invoice is equal to the meter point days multiplied by the levy. The levy rate is set annually by the Department for Energy Security and Net Zero, published by 31 December before the beginning of the financial year, and is based on the projected GGSS spend including Ofgem's administrative costs and headroom required to account for uncertainties around spend and levy collection:

- November 2021 – March 2022: 0.484 p/meter/day (£0.59/meter annually)[76]
- April 2022 – March 2023: 0.576 p/meter/day (£2.10/meter annually)[77]
- April 2023 – March 2024: 0.122 p/meter/day (£0.45/meter annually)[78]

Ofgem will request submission of meter point data no more than 7 days after the start of a quarter. Suppliers will then have 5 days to submit and verify the meter point data from the point it is requested via an online portal. Ofgem issue the invoice based on this information, the supplier has 14 days to pay this invoice. Ofgem may utilise their enforcement framework to ensure a supplier makes the requested payment. Initially, Ofgem will open discussions with the supplier to try and resolve a missed payment. If this approach does not resolve the issue an enforcement notice will be served before Ofgem initiate the credit cover draw down process.

In 2022, the world entered an energy crisis, with the UK price of natural gas and electricity rising rapidly. The tariffs energy suppliers can charge domestic consumers is limited by the Energy Price Cap. Rapid increases in wholesale costs led to suppliers with insufficient protections collapsing. To combat this, the price cap was increased repeatedly throughout the year. The Price Cap would have increased such that the average household annual bill would have been £3,280 from 1st April 2023. However, domestic consumers were partially protected by the introduction of the Energy Price Guarantee, which was initially set to limit the average household annual bill at £2,500. The gap between the Price Cap and the Price Guarantee has been provided to suppliers by the Government.

The Government has committed to transitioning to a volumetric GGL when feasible. However, this is not currently feasible given the potential impact of a volumetric levy on some companies.

Other related policies

Renewable Transport Fuel Obligation

The Renewable Transport Fuel Obligation (RTFO) requires fuel suppliers, which supply at least 450,000 litres per annum of fossil and renewable fuels, to show that a percentage of the fuel they supply comes from renewable and sustainable sources. The scheme began in 2008 and covers fuels used in road and certain non-road transport applications. Obligated suppliers

[76] BEIS (2022), Green Gas Levy (GGL): rates, underlying variables, mutualisation threshold for the first and second scheme years (period from 30 November 2021 to 31 March 2023)
[77] BEIS (2022), Green Gas Levy (GGL): rates, underlying variables, mutualisation threshold for the first and second scheme years (period from 30 November 2021 to 31 March 2023)
[78] DESNZ, Green Gas Levy (GGL): rates, underlying variables, mutualisation threshold for the 2023-2024 financial year

can meet their obligation by either redeeming Renewable Transport Fuel Certificates (RTFC) or by paying a fixed sum for each unit of fuel they wish to 'buy-out' from their obligation. RTFCs are created and provided to participants who supply renewable fuels based on the quantity of biofuel they generate. These certificates can then be traded on the open market to allow other suppliers to meet their obligations.[79] Companies that supply less than 450,000 litres a year in the UK can also register if they want to claim RTFCs.

Because the GGSS and RHI are a tiered system the financial benefits decrease as the quantity of energy injected into the grid increases. Hence, some operators may choose to claim RHI or GGSS payments for a portion of the injected biomethane before switching to claiming RTFC for the remaining portion. Biomethane can be compressed and used as a transport fuel in the same way LNG and CNG are used, the only difference being bio-LNG and bio-CNG are sourced from organic feedstock rather than being a fossil fuel. As the price of an RTFC is directly linked to the obligation amount any increase to the obligation could promote RTFOs over the GGSS. This competition could reduce the amount of injected biomethane under the GGSS if operators deemed the RTFO a more attractive option.

Green Gas Certification Scheme

A Guarantee of Origin (GoO) is a certificate detailing the origin of renewable electricity or fuel. The guarantee of origin framework was initially created in 2009 after the Renewable Energy Directive (RED) set targets of 20% renewable energy by 2020 for the European Union.[80] When 1 MWh of renewable energy or fuel is produced, a certificate is issued to the producer. This certificate can be traded within the European Single Energy market and allows consumers to ensure the consumption of renewable electricity or fuel.

There are two certification schemes that issue certificates to biomethane producers. These are the Green Gas Certification Scheme (GGCS) and the Biomethane Certification Scheme (BCS). Both schemes are mechanisms by which injectors of biomethane in the UK can receive GoO certificates. For each kWh of biomethane generated and injected into the grid under the GGCS or BCS, a renewable Gas Guarantee of Origin (RGGO) is created which can then be sold in addition to the physical sale of the biomethane.

The RGGOs are transferred from the biomethane producers to the GGCS Registration Database and BMS equivalent, from which they are allocated to gas consumers. These consumers can be domestic or non-domestic. The gas consumer is allocated a RGGO matching the gas they have taken from the gas network, at this point the certificate is 'retired' and can no longer be transferred to any other sites. The gas they have consumed must have been withdrawn from the same Distribution Network into which the biomethane, represented by the RGGOs they have been allocated, was injected. The scheme is predominantly for use in the UK, however, consumers connected to a grid outside of the UK can be allocated RGGOs

[79] RTFO (2021), *Renewable Transport Fuel Obligation (RTFO): Compliance, Reporting and Verification.*
[80] European Commission (2022). *Renewable energy directive (europa.eu).*

generated in respect of biomethane injected within the UK and can make a claim of biomethane use.[81]

The GGCS issues RGGOs for approximately 80% of all biomethane injection in the UK. The GGCS is managed by Renewable Energy Assurance Limited and provides complementary benefits to biomethanes injectors alongside the GGSS.[82] The remaining RGGOs were issued by the BMCS which was operated by Green Gas Trading but no longer issue new certificates.

[81] GGCS (2022). *About Renewable Gas Guarantees of Origins (RGGOs)*.
[82] GGCS (2022). *An Introduction to the Green Gas Certification Scheme*.

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