Impact Assessment

Division:	Energy Systems Management & Security Directorate
Team:	Energy Markets and Security / Gas & Hydrogen Systems Management and Operation
Associated Document:	Proposed Modifications to Cadent's Connection Charging Methodology
Coverage:	Partial coverage which means that the monetary costs and benefits are only one element of the decision.
Type of measure:	
Type of IA:	Final IA – Non-Qualified under Section 5A UA 2000
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Summary: Cadent CCM Change (A) - High Cost Cap for Entry Connections

Cadent Gas Limited proposes changes to its Connection Charging Methodology (CCM) in accordance with Standard Condition 4B of its Gas Transporter Licence[1] and has furnished the Authority with its proposed modifications. The Authority has agreed that it shall consider the impact of two components, the High Cost Cap (HCC) and changes to financial security, separately against the Relevant Objectives in the licence. This specific impact assessment is for the High Cost Cap for Entry Connections.

The Authority shall decide whether the proposals better achieve the Relevant Objectives of the Gas Transporter Licence. If the Authority concludes that the changes do not support Ofgem's Strategic Outcomes, it may reject the proposal and deny the modification of the CCM.

[1] Gas Transporters Licence: Standard Conditions

What is the problem under consideration? Why is Ofgem intervention necessary?

Current charging arrangements[2] require parties connecting to a distribution network to pay the full cost of network reinforcement, the upgrade or expansion of gas transportation infrastructure. Cadent asserts this to be a barrier to entry for new market entrants suggesting that it inhibits competition, especially for biomethane green gas projects.

The High Cost Cap (HCC) will reduce the amount certain eligible parties connecting to distribution networks must pay for network reinforcement, with costs being 'socialised' across network users using a new 'use it or lose it' (UIOLI) funding mechanism established under RIIO3. Ofgem is seeking to verify that the proposals achieve their stated policy aims and therefore better achieve the Relevant Objectives of the licence.

What are the policy objectives and intended effects including the effect on the Relevant Objectives

In reviewing these proposals we consider how they deliver on Cadent's stated policy objectives then the extent to which they better achieve the Relevant Objectives of the licence and align with Ofgem's principal objective and statutory duties.

According to Cadent's proposal, the HCC seeks to achieve the following policy objectives:

- lower the barriers to entry for distributed biomethane projects,
- increase the number of gas Entry Connections, and
- improve utilisation of network capacity.

In meeting these objectives, Cadent seeks to facilitate competition in gas supply, support the transition to Net Zero, ensure cost reflectivity and consumer protection, enable efficient network investment and introduce a transparent and predictable charging framework.

[2] See Section 4.2 of Cadent Gas Ltd's Connections Charging Methodology

What are the policy options that have been considered, including any alternatives to regulation? Please justify the preferred option (further details in Evidence Base)

Cadent had previously considered[3] a range of options including maintaining the status quo and taking no action. Maintaining the status quo was considered a significant barrier to new distributed gas entry, especially for biomethane plants. Other solutions considered included a qualitative entry test, reinforcement prices (where some of the costs of reinforcement for a location are factored into connection prices) and an all or nothing cap. These options are explained in more detail in 1.15.

[3] See, Entry Gas Connection Charging Consultation, June 2022

Preferred option - Monetised Impacts (£m)

Net Present Social Value (NPSV)[4]	**£676m**
Benefit-Cost-Ratio (BCR)[5]	**1.66**
Value for Money (VfM) Categorisation[6]	**Medium**
Average annual consumer bill impact	**£1.17**
Net benefit is present in Net Present Social Value (NPSV) terms relative to the counterfactual. The NPSV has been calculated using 2025 as the base year, over a 20-year appraisal period to account for the typical lifetime of a biomethane plant. Economic costs and benefits are in 2025 prices and cover the period from 2026 – 2045.	

Preferred option - Hard to Monetise Impacts

Describe any hard to monetise impacts, including mid-term strategic and long-term sustainability factors following Ofgem IA guidance (maximum 10 lines).

Competition impacts: A key objective of the HCC proposal is to increase competition in the biomethane industry and the supply of gas more generally, potentially resulting in lower prices for future consumers. However, the impact on competition is difficult to monetise and the impact on future prices, even more challenging. We have used the Herfindahl-Hirschman Index (HHI) to identify potential competition impacts, however, since consumers are not given a choice in the gas they receive, potential changes in future gas prices have not been quantified or monetised.

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[4] As defined in the Green Book (2022), the Net Present Social Value (NPSV), is the sum of the value of all benefits, less all costs, in each year when discounted can be added together because they are in present value (discounted) terms, and then represent net cost benefit (benefits minus costs).
[5] As defined in the Green Book (2022), the Benefit Cost Ratio (BCR) as a ratio of the present value of benefits to the present value of costs. It provides a measure of the benefits relative to costs.
[6] DFT value for money framework – This document assigns a category to the BCR derived impact assessments. They provide a succinct, overarching summary of the outcome of an often complex economic appraisal. A Medium BCR is implied by a BCR greater than or equal to 1.5 and less than 2.0

Security of supply impacts: Biomethane provides an additional source of energy to meet UK domestic demand. According to Cadent's submissions[7] as well as industry sources[8], biomethane presents a credible year-round production source characterised by stable and consistent outputs, resistant to external economic shocks to gas supply. On this basis, biomethane can act as a steady of source of domestic gas supply and can therefore be expected to improve the UK's security of supply.

A variety of different sources provide a wide range of expected figures for biomethane output. A report by Regen[9] suggests 33TWh split between being injected into the grid, power generation, transport and industry. Notably, the Climate Change Committee's 7th annual Carbon Budget assumes between 30 – 40TWh of biomethane will be present in the UK's energy portfolio by 2050[10] whereas the Green Gas Taskforce predict that more than 100TWh could be deployed by the same date.[11] It has not been possible to quantify or monetise the overall impact of this, though we expect there to be an overall benefit to security of supply.

Key Assumptions/sensitivities/risks

The key assumptions and sensitivities used in our quantitative analysis are detailed in chapter 2. This final IA should also be read in conjunction with the accompanying decision document[12].

This analysis is aligned as closely as possible to the BEIS 2021 Green Gas Support Scheme (GGSS) Impact Assessment[13]. The methodology employed for biomethane plant CO2e emissions follows Green Book[14] guidance and is derived using the data tables in the Green Book Supplementary Guidance[15].Net ammonia emissions and fertiliser savings per GWh of biomethane produced are derived using figures from the GGSS IA. One significant

[7] Entry Connections Charging Methodology Conclusions Report – Cadent Gas, September 2025
[8] Unlocking the potential of biomethane - Cadent Gas Ltd
[9] Regen (September 2025) - Making the most of biomethane - An examination of biomethane's role in the energy transition
[10] Future Policy Framework for Biomethane Production (2024)
[11] Green Gas Taskforce – Unlocking the Future of Biomethane
[12] Proposed Modification to Cadent's Connection Charging Methodology, December 2025
[13] Final Stage IA: Green Gas Support Scheme/Green Gas Levy - BEIS - September 2021
[14] The Green Book and accompanying guidance - GOV.UK
[15] Green Book supplementary guidance: valuation of energy use and greenhouse gas emissions for appraisal - GOV.UK

divergence from the GGSS methodology has been the inclusion of propanation costs, which has been applied to 10% of biomethane, as per evidence provided by Cadent.

1. Introduction

Section summary

This chapter discusses purpose of the Impact Assessment, including detailing the current charging methodology, Cadent's proposed CCM amendment and our objectives for evaluating the costs and benefits of the proposal.

1.1. Cadent Gas Limited proposes changes to its Connection Charging Methodology (CCM) in accordance with Standard Condition 4B of its Gas Transporter License.

1.2. For the purposes of our review, Cadent has divided its proposal into two components:

- Entry Connections: High Cost Cap
- Entry Connections: Financial Securities.

1.3. This specific impact assessment is concerned with the first of the two modification components: a High Cost Cap for Entry Connections.[16] Cadent has furnished the Authority with a report setting out its proposed modification and how the proposed modification would better achieve the Relevant Objectives of the licence.

Relevant Objectives

1.4. The Relevant Objectives for CCMs are detailed in Condition 4B[17] as follows:

a) compliance with the connection charging methodology facilitates the discharge by the licensee of the obligations imposed on it under the Act and by this licence;

[16] A separate impact assessment has been produced for the Entry Connections: Financial Securities proposal, and has been published alongside this proposal.
[17] See, Gas Transporters Licence: Standard Conditions (as at 1 Dec 2025).

b) compliance with the connection charging methodology facilitates competition in the supply of gas, and does not restrict, distort, or prevent competition in the transportation of gas conveyed through pipes;

c) compliance with the connection charging methodology results in charges which reflect, as far as is reasonably practicable (taking account of implementation costs), the costs incurred by the licensee in its transportation business and, where the Act enables, to charge a reasonable profit;

d) so far as is consistent with sub-paragraphs (a), (b) and (c), the connection charging methodology, as far as is reasonably practicable, properly takes account of developments in the licensee's transportation business;

e) compliance with the connection charging methodology ensures that the licensee shall not show any undue preference towards, or undue discrimination against, any person who operates, or proposes to operate, a pipe-line system in relation to the connection of that system to the pipe-line system to which this licence relates; and

f) the connection charging methodology is compliant with the Regulation and any relevant legally binding decisions of the European Commission and/or the Agency for the Co-operation of Energy Regulators.

1.5. On the basis of the two impact assessments, the Authority shall decide whether the proposals better achieve the Relevant Objectives of the Gas Transporter Licence and whether modifications align with Ofgem's principal objective and statutory duties. If the Authority concludes that the changes do not better facilitate the Relevant Objectives, or do not align with Ofgem's principal objective and statutory duties, it may reject the proposal and deny the implementation of the new CCMs.

Problem under consideration

1.6. Where there is new connection of entry facilities to the distribution networks, current charging arrangements require gas producers to pay the full cost of network reinforcement ("deep connection charges"). Cadent has identified that these high and sometimes unpredictable costs act as a barrier to entry for new market entrants and inhibit competition. As Cadent expects the majority of, if not all, distributed Entry Connections to be biomethane in the short to medium term, this technology is particularly impacted.

1.7. Cadent's evidence suggests that, under the current arrangements, some biomethane projects are deterred or do not proceed because developers cannot accommodate or reliably forecast reinforcement costs. This limits the number of new gas Entry Connections and constrains the growth of green gas on the network.

1.8. To address this problem, Cadent proposes introducing a High Cost Cap (HCC) on reinforcement costs for biomethane entry connections. The HCC would cap the amount paid by the connected entities, with any reinforcement costs above the cap socialised across the wider customer base.

1.9. Cadent considers that the HCC would reduce the up-front cost burden on biomethane projects, remove a key barrier to market entry, and support increased competition and progress towards Net Zero, while having a minimal impact on consumer bills.

1.10. The RIIO-3 Final Determinations, published[18] on 4 December 2025 introduced a 'use it or lose it' (UIOLI) mechanism for GDNs to support biomethane connections (to date, all biomethane plants in Cadent's network have been developed using the Green Gas Support Scheme, though reinforcement costs are not covered by the scheme), subject to limitations of £20m per GDN network (of which Cadent has four – allowing up to £80m of reinforcement costs to be socialised during the RIIO3 period) and £2m per project. This will form the basis of and fund the socialisation mechanism applied by Cadent.

Policy objective

1.11. In reviewing these proposals we consider the extent to which proposed changes better achieve the Relevant Objectives of the licence and align with Ofgem's principal objective and statutory duty.

1.12. According to Cadent, the cap should support the following outcomes:

i. Lower Entry Barriers for Distributed Biomethane Gas Projects: Biomethane producers have historically faced high upfront reinforcement costs, which has

[18] RIIO-3 Final Determinations – Gas Distribution

been asserted as a reason for why they have not connected to the gas grid and maximised their output.

ii. Increased Number of Gas Entry Connections: By making connections more financially viable, the proposals are expected to stimulate new projects and increase gas injection into the grid.

iii. Improved Utilisation of Network Capacity: Through shared reinforcements and better coordination, the network can accommodate more distributed gas without inefficient duplication of infrastructure.

1.13. Cadent mentioned several second order effects such as:

i. Facilitating Competition in Gas Supply: By reducing the upfront cost burden on new distributed biomethane gas entry connections, the HCC aims to remove a claimed barrier to market entry, particularly for green gas producers. This supports the relevant Licence objective of promoting competition in the supply of gas.

ii. Supporting the Transition to Net Zero: The HCC is designed to enable more biomethane projects to connect to the network. Therefore, the proposal aligns with broader government policy to decarbonise heat and increase the proportion of green gases (e.g. biomethane) in the gas grid.

iii. Ensuring Cost Reflectivity and Consumer Protection: The HCC introduces a cap on the reinforcement costs borne by biomethane connectees, with costs above the cap socialised across the wider customer base. This balances the need to facilitate entry with the obligation to levy cost-reflective and non-discriminatory charges.

iv. Enabling Efficient Network Investment: By allowing coordinated reinforcements and shared infrastructure, the HCC supports more efficient planning and delivery of network upgrades.

1.14. The specific test that is applied when considering revisions to CCMs is whether they better achieve the Relevant Objectives of the licence. The Relevant Objectives are set out above in para. 1.4 and considered in line with Ofgem's principal objective, to protect the interests of existing and future consumers in relation to gas conveyed through pipes, as well as our statutory duties to promote economic growth and to support the UK Government’s Net Zero target.

Description of alternative options considered

1.15. Cadent has previously considered a range of options including maintaining the status quo and taking no action. In relation to this decision, Ofgem only has the power to veto proposals and cannot modify or suggest alternative policy options. Therefore, other options considered by Cadent were not assessed as part of this IA[19]. However, as noted above, maintaining the status quo was considered a significant barrier to new distributed gas entry, especially for biomethane. Other options considered, but discounted, include:

i. An Entry Test: whereby qualitative assessment of social benefit is used to consider whether the reinforcement costs should be socialised. This would be more complex and potentially discriminatory.

ii. Reinforcement Prices: whereby connection prices are published having already factored in a proportion of reinforcement costs to be socialised linked to demand and capacity in that location.

iii. An All Or Nothing Cap: similar to the core proposal but would be set higher than the HCC. Below the cap, all costs would be socialised – above, the connecting party would pay the full costs.

[19] Gas Transporter License, Standard Conditions, Section 4B(6)

2. Approach to the Impact Assessment

Section summary

This chapter provides a summary of the chosen option and the counterfactual that we have assessed them against. We also describe our approach to assessing the impact of the option on industry and consumers.

Scope of impact Assessment

2.1. The scope of this impact assessment (IA) is to consider the costs and benefits of the High Cost Cap (HCC) proposal, and to assess whether the proposal better facilitates the connection charging objectives and aligns with Ofgem's principal objectives and statutory duties.

2.2. We have sought to undertake quantitative analysis wherever possible to inform this IA. However, data availability, time constraints and the need for proportionate analysis, security of supply impacts have been discussed qualitatively rather than quantitatively. We have also aligned as closely as possible with the methodology employed within this IA with the GGSS approved methodology.

Methodology

2.3. This impact assessment includes the following quantified and monetised impacts – since the financial cost of the policy is a transfer from business to consumers, this is considered a transfer of costs (rather than a new, additional cost) and therefore, this impact assessment can be considered an environmental impact assessment:

2.3.1. Carbon emissions reductions from biomethane replacing demand for natural gas[20]. These emissions have been monetised using Green Book guidance and

[20] The Regen (September 2025) - Making the most of biomethane - An examination of biomethane's role in the energy transition and GGSS IA have been used to identify emissions reductions.

applying appropriate carbon prices in the Supplementary Guidance and Data Tables.

2.3.2. An increase in carbon emissions due to the need for roughly 10% of biomethane requiring propanation[21] to be injected into the gas grid.

2.3.3. Air quality impacts/damage costs[22] due to increased ammonia emissions, released as a by-product of biomethane production.

2.3.4. Reduced air quality impacts and damage costs due to the counterfactual use of feedstock used for biomethane production.

2.3.5. Fertiliser cost savings: Decreased synthetic fertiliser usage due to increased digestate production.

Baseline

2.4. The baseline for costs, carbon emissions and air quality/damage costs used is based on the annual gas consumption for 2024. Cadent have provided data for 18 biomethane plants which are currently operational but need reinforcement to maximise output, and 30 plants which are currently unable to enter the market due to high reinforcement costs.

Counterfactual

2.5. The counterfactual use of feedstock is assumed to be the same as those used in the GGSS IA, for example where some of the feedstock is assumed to go to landfill, releasing high concentrations of ammonia as a result. These ammonia emissions are included in the net ammonia emissions figures, which have been calculated overall as 0.62 tonnes of ammonia per GWh of biomethane produced.

[21] Propanation refers to the enrichment of biomethane with propane, to increase the calorific value of biomethane.
[22] Damage costs refer to the impacts on human health caused by high concentrations of ammonia.

Scenarios

2.6. The proposed HCC is currently set at £1952 standard cubic meters per hour (scm/h) which translates to an estimated £2m per biomethane plant. In total, there are 48 biomethane plants that require reinforcement. To account for the inherent uncertainties around this policy, particularly around the total number of biomethane plants that will be successful upon application for the GGSS and for reinforcement costs, we have modelled three scenarios; a low scenario (21 biomethane plants being reinforced), central scenario (30 biomethane plants being reinforced due to a maximum amount of £20m per network allowed to be socialised over the RIIO-3 period) and a high scenario (where all 48 biomethane plants are reinforced up to the HCC and therefore all plants able to enter the market and maximise output).

2.7. The high and low scenarios assume each plant will have reinforcement costs of £2m. The central scenario assumes that the RIIO-3 final determinations allow for a maximum of £20m reinforcement costs per network being socialised. In the case of Cadent, this means they will be allowed a total of £60m to be socialised across the RIIO-3 period (London has been excluded due to the fact that no biomethane plants are planned to be built in London).

Consumer Bill Impact

2.8. To calculate the consumer bill impact, the socialised reinforcement costs have been divided by the total number of consumers on each of Cadent's networks. The NESO Future Energy Scenarios (FES) 2025: Pathways to Net Zero[23] has been used to determine the number of consumers remaining on the gas networks each year. The 'Falling Behind' pathway is expected to be the most likely and therefore our central scenario mirrors this trend in the decline of consumers. London does not have any existing or proposed biomethane plants and therefore has been excluded from the analysis. Since the cost per

[23] Future Energy Scenarios: NESO Pathways to Net Zero 2025 Data Workbook – The Heat pump stock graph on tab F.44 has been used as the best analogy for the remaining customers on the gas network until 2050. All 4 pathways are included in the graph.

consumer does not exceed £10 per year, it has not been possible to measure downstream fuel poverty impacts using DESNZ's Low Income and Low Energy Efficiency model.

Emissions impact

2.9. The output of each biomethane plant has been modelled based on the flow rate and expected hours of operation (provided by Cadent). This output will replace existing gas demand and therefore, the reduction in carbon emissions, increase in ammonia emissions and change in air quality/damage costs have been quantified and monetised using Green Book methodology, Defra's Air Quality/Damage Costs toolkit[24] and evidence from BEIS 2021 Green Gas Support Scheme Impact Assessment.

Calorific Value and Propanation

2.10. The average calorific value ("CV") for biomethane is 36MJ/m^3 [25], compared to the average calorific value of natural gas at 39.4MJ/m^3 [26] , with an allowable range of 36.9MJ/m^3 and 42.3MJ/m^3.[27] Under the Gas (Calculation of Thermal Energy) Regulations 1996[28], as amended ("the Regulations"), Ofgem is responsible for ensuring that customers are protected from the financial impact of receiving gas that is of a significantly lower calorific value than they are charged for. This means that biomethane may need to be propanated to bring the calorific value up to 39.4MJ/m^3(though this is dependent on the calorific value of the gas at the time). Evidence provided by Cadent suggests 10% of all biomethane requires propanation, yielding additional carbon and ammonia emissions. This has been accounted for in the calculation of carbon emissions and damage costs/air quality impacts. Since propanation will occur before being injected into the gas grid, the financial costs borne by the biomethane plants falls outside of the scope of this impact assessment.

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[24] Air quality appraisal: damage cost guidance – This guidance details the process for assessing the air quality impact of a policy or project and was used for the ammonia values within this Impact Assessment.
[25] IEA – An Introduction to Biogas and Biomethane –Section - What are biogas and biomethane?
[26] Digest of UK Energy Statistics (DUKES): calorific values and density of fuels – 2025 value for Natural Gas consumed. This is the weighted average of calorific values will approximate the average for the year of entering the National Transmission System and what readers will see quoted on their gas bills.
[27] Gas Quality Parameters at NTS Entry Points- The Gross Calorific Value (real gross dry) shall be in the range 36.9 to 42.3MJ/m3, in compliance with the Wobbe Number, ICF and SI limits
[28] Regulations 6 & 9, Gas (Calculation of Thermal Energy) Regulations 1996

Fertiliser Saving

2.11. Digestate is a by-product of anaerobic digestion. If the source mix has higher nitrogen content, a higher quality digestate is created, displacing larger quantities of synthetic fertiliser for use in the agricultural sector. This is an expected saving from the greater volume of biomethane being produced, as set out in the GGSS IA. The value of avoided synthetic fertiliser costs is the average of monthly spot prices from 2017-2020 published by Agriculture and Horticulture Development Board[29].

Competition Impacts

2.12. These have been assessed using the Herfindahl–Hirschman Index (HHI) which measures the concentration of a market. Results between 0 and 1,000 indicate that markets are highly competitive (where 0 is perfectly competitive), between 1,000 and 1,800 indicating markets are moderately competitive and results above 1,800 indicating higher, though acceptable levels of market concentration (the higher the figure, the closer to natural monopoly a market is).

Security of Supply

2.13. These impacts have been considered qualitatively. Increasing biomethane output to be used as a source of energy means GB has additional sources of flexible gas, resulting in a greater ability to meet potential peak demand scenarios such as '1 in 20' (the level of daily demand which would only be exceeded once in every twenty winters – a capacity obligation Gas Distribution Networks must ensure is met).

2.14. A variety of different sources provides a wide range of expected figures for biomethane output. A report by Regen[30] suggests 33TWh split between being injected into the grid, power generation, transport and industry. Notably, the Climate Change Committee's 7th annual Carbon Budget assumes between 30 – 40TWh of biomethane will be present in the UK's energy portfolio by 2050[31] whereas the Green Gas Taskforce predict

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[29] Agriculture and Horticulture Development Board (AHDB) - Great Britain fertiliser prices. Information used within BEIS 2021 GGSS Impact Assessment
[30] Regen, Making the most of biomethane
[31] DESNZ - Future Policy Framework for Biomethane Production (2024)

that more than 100TWh could be deployed by the same date.[32] The increase in biomethane will reduce reliance on third-party nations for gas supply, with less exposure to geopolitical events. It has not been possible to quantify or monetise the overall impact of this, though we expect there to be an overall benefit to security of supply.

2.15. Unlike other major sources of gas, biomethane is largely insulated from external economic shocks due to its production method. Biomethane produces on a constant basis year round, (as presumed in the paragraph 2.20, with the suggested running hours), thereby reducing volatility and contributing to stable domestic supplies.

2.16. No decision has been made as yet on Hydrogen Blending at distribution level, however, it is worth noting that should government move to enable hydrogen blending at distribution level, the presence of biomethane plants on distribution networks would assist networks to balance calorific value levels caused by entry of hydrogen[33] onto networks, thereby increasing security of supply.

Key Assumptions

2.17. Without the socialisation of reinforcement costs, it is assumed these biomethane plants will not be built, as detailed in Cadent's original proposal. Whilst the GGSS provides subsidies to build biomethane plants, this funding does not cover reinforcement costs, which according to Cadent, is a big enough barrier to entry that the plant is not built. The reinforcement cost is a transfer of costs[34] and therefore, is not included in the Net Present Social Value (NPSV) calculation.

2.18. Biomethane plants have an average lifetime of 20 years, therefore, it is assumed benefits will be achieved over a 20-year appraisal period. No assumption has been made of a biomethane plant shutting down before the natural end of its lifetime.

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[32] Green Gas Taskforce – Unlocking the Future of Biomethane
[33] Pure hydrogen has a calorific value of 12.1MJ/m^3 (Energy Network Association) – Legislative framework for hydrogen blending)
[34] Economic transfers are detailed in Section 6.3 of the Green Book and state that transfers benefit the recipient and are a cost to the donor and therefore do not make society as a whole better off.

2.19. All biomethane plants considered in this IA are expected to have connections reinforced during the RIIO-3 period (2026 – 2031) and costs will be socialised in the year they incur. For the purpose of this analysis, it is assumed reinforcement and socialisation of costs occur evenly over the last four years of the RIIO-3 period (allowing for applications to be approved and feasibility studies to occur in the first year, meaning plants will be built and pipes reinforced from 2027 onwards).

2.20. A biomethane plant is assumed to be producing output 7,884 hours annually (90% usage), in line with evidence provided by Cadent.

2.21. All biomethane plants will be funded by the GGSS, meaning they are legally required to adhere to and report on their use of best practises (such as digestate spreading, which lowers the concentration of ammonia in any single area) to reduce the air quality/damage costs. Therefore, the damage costs calculated in this IA could in reality be lower.

2.22. The NESO Future Energy Scenarios (FES) 2025: Pathways to Net Zero - 'Falling Behind' Pathway has been used to estimate the remaining number of consumers left on the network.

2.23. A social discount rate of 3.5% for non-health impacts and 1.5% for specific health related impacts, as set out in Defra's Air Quality and Damage Costs toolkit.

2.24. 10% of all biomethane will require propanation to increase its calorific value so that it can be injected into the gas grid. This is explained in more detail in the methodology section.

Results

2.25. The results from the analysis are detailed below. Other than table 1, which is determined over the RIIO-3 time period, the costs and benefits for the options are assessed over the policy appraisal time period (20 years), as detailed in section 2.18

2.26. Throughout the results documented in Tables 1 to 5, the central price of carbon has been used. Table 6 and Table 7 give the difference between the Green Book's predicted low and high carbon prices for each of the three scenarios.

2.27. Table 1 demonstrates the quantified emissions benefits for each of the scenarios. The total CO2e benefit accounts for the CO2e cost of producing biomethane, the CO2e cost for using propane to propanate and the CO2e benefit from abating natural gas. This benefit ranges from 2.00MtCO2e to 4.35MtCO2e. The total ammonia cost is due to the increased biomethane production as detailed in section 2.5. The cost ranges from -16.73kt to -36.30kt. Total gas abated in TWh is the gas replaced by biomethane, accounting for the differences in calorific value. This ranges from 25.91TWh to 56.20TWh.

Table 1: Quantified emissions benefits for each scenario

Scenarios	Low Scenario	Central Scenario	High Scenario
Natural Gas CO2 abatement benefit (MTCO2e)	4.51	6.18	9.78
Biomethane CO2 emissions cost (MTCO2e)	-1.86	-2.56	-4.04
Propane CO2 emissions cost (MTCO2e)	-0.65	-0.88	-1.40
Overall CO2 Benefit (MTCO2e)	**2.00**	**2.75**	**4.35**
Ammonia emissions cost (kt)	-16.73	-22.94	-36.30
Total Gas Air Quality/ Damage Cost Benefits (TWh)	25.91	35.52	56.20

2.28. Table 2 demonstrates the equivalent monetised impact for the quantified emissions benefits in Table 1. The total carbon reduction benefit ranges from £505m to £1086m, reducing contributions to climate change as a result. This is a societal benefit, rather than an individual consumer benefit. The total ammonia cost ranges from £-156m to -£337m. There is a gas health benefit that is associated with displacing natural gas with other sources of gas, as detailed in section 2.4. This benefit ranges from £38m to £82m. Increased biomethane usage causes decreased synthetic fertiliser usage and therefore results in a cost saving, as detailed in section 2.11. This ranges from £80m to £171m.

Table 2: Monetised impacts (Benefits & Costs)

Scenarios	Low Scenario	Central Scenario	High Scenario
Natural Gas CO2 abatement benefit	£1136m	£1547m	£2444m
Biomethane usage CO2 cost	-£469m	-£638m	-£1008m
Total Propane CO2 cost	-£162m	-£221m	-£349m
Total CO2 benefit	**£505m**	**£687m**	**£1086m**
Total Fertiliser benefit	£80m	£108m	£171m
Total Gas Air Quality/Damage Cost benefit	£38m	£52m	£82m
Total Ammonia Air Quality/Damage Cost	-£156m	-£214m	-£337m

2.29. Table 3 details the overall benefits/costs to the end consumer, accounting for the previously discussed impacts. The methodology for monetising these impacts is stated in 2.3. These are then aggregated to calculate the final Net Present Social Value (NPSV).

2.29.1. The Net Present Social Value (NPSV) ranges from £459m to £1090m, with a central estimate of £676m. This means the overall benefits exceed the costs by £676m over the 20-year period, in the central scenario.

2.29.2. The Benefit Cost Ratio (BCR) in the central scenario is 1.66, meaning for every £1 incurred in costs, £1.66 is received in benefits.

Table 3: Overall Net Present Value and BCR

Scenarios	Low	Central	High
Total Benefits	£1254m	£1707m	£2697m
Total Costs	£795m	£1031m	£1607m
Net Present Social Value (NPSV)	£459m	£676m	£1090m
BCR	1.58	1.66	1.68

2.30. Table 4 below details the annual direct impact to consumer bills across the three different scenarios throughout the RIIO-3 period (the period which costs can be socialised). This is despite the cost being a transfer of costs, as defined in section 2.17. The total consumer bill impact ranges between £4.87 to £11.23 for the 5-year period.

Table 4: Yearly bill impact for the consumer across the RIIO-3 period

Scenarios	Low	Central	High
2026	£1.38	£1.38	£2.07
2027	£1.39	£1.39	£2.08
2028	£1.40	£1.40	£2.10
2029	£0.71	£1.41	£2.12
2030	£0.00	£1.43	£2.14
2031	£0.00	£0.00	£0.72

2.31. Table 5 details the HHI change, as described in section 2.12. If the policy was not to be implemented the HHI remains at 294.4, whereas, if the policy was implemented, the HHI would range from 186.9 for the low scenario to 125 for the high scenario. This suggests that post the application of the HCC, increased biomethane output from new and existing sites in all scenarios creates a market that will be less concentrated and more competitive compared to the 2025 baseline.

Table 5: Herfindahl-Hirschman Index (HHI)

Monetised Impacts	Baseline	Low Scenario	Central Scenario	High Scenario
HHI	294.4	186.9	160.6	125

Sensitivity Analysis

2.32. We have undertaken some sensitivity analysis using lower and higher carbon prices, according to the Green Book Methodology, to understand impacts if carbon prices were to fluctuate. These are documented in Tables 6 & Table 7.

2.33. Table 6 details the overall benefits/costs using the low carbon price scenario, as set out in the Green Book supplementary guidance Data Table.

2.33.1. The Net Present Social Value (NPSV) ranges from £211m to £515m, with a central estimate of £318m. This means the overall benefits exceed the costs by £318m over the 20-year period, in the central scenario.

2.33.2. The Benefit Cost Ratio (BCR) in the central scenario is 1.58, meaning for every £1 spent, £1.52 is received in benefits.

Table 6: Overall Net Present Value and BCR using sensitivity analysis for low carbon price scenario

Scenarios	Low Scenario	Central Scenario	High Scenario
Total Benefits	£686m	£934m	£1475m
Total Costs	£475m	£617m	£961m
Net Present Social Value	£211m	£318m	£515m
BCR	1.44	1.52	1.54

2.34. Table 7 details the overall benefits/costs using the high carbon price scenario, as set out in the Green Book supplementary guidance Data Table.

2.34.1. The Net Present Social Value (NPSV) ranges from £708m to £1666m, with a central estimate of £1035m. This means the overall benefits exceed the costs by £1035m over the 20-year period, in the central scenario.

2.34.2. The Benefit Cost Ratio (BCR) in the central scenario is 1.72, meaning for every £1 spent, £1.72 is received in benefits.

Table 7: Overall Net Present Value and BCR using sensitivity analysis for high carbon price scenario

Scenarios	Low Scenario	Central Scenario	High Scenario

Total Benefit	£1812m	£2481m	£3919m
Total Cost	£1114m	£1446m	£2252m
Net Present Social Value	£708m	£1035m	£1666m
BCR	1.63	1.72	1.74

2.35. As stated in section 2.10, the CV for natural gas is variable and we have undertaken some sensitivity analysis using CV of the low range and high ranges of allowable values in the Gas Distribution Network.

2.36. Table 8 details the overall benefits/costs using the following natural gas CVs, 36.9MJ/m^3, 39.4MJ/m^3 and 42.3MJ/m^3 for the central scenario.

2.36.1. The Net Present Social Value (NPSV) ranges from £567m to £784m, with a central estimate of £676m. This means the overall benefits exceed the costs by £676m over the 20-year period, in the central scenario.

2.36.2. The Benefit Cost Ratio (BCR) in the central scenario is 1.66, meaning for every £1 spent, £1.66 is received in benefits.

Table 8: Overall Net Present Value and BCR using sensitivity analysis for high carbon price scenario

Scenarios	Scenario 1	Scenario 2	Scenario 3
Calorific Value (MJ/m3)	36.9	39.4	42.3
Total Benefit	£1816m	£1707m	£1598m
Total Cost	£1031m	£1031m	£1031m
Net Present Social Value	£784m	£676m	£567m
BCR	1.76	1.66	1.55

3. Conclusions

Section summary

This chapter brings together the findings of our quantitative and qualitative analysis to determine whether the HCC delivers a satisfactory outcome for customers.

3.1 We have considered both the monetised and non-monetised benefits of the High Cost Cap (HCC) proposal, and whether the proposal better achieves the Relevant Objectives of the licence and aligns with Ofgem's principal objectives and statutory duties.

3.2 We acknowledge the uncertainty regarding a number of the assumptions that have informed this analysis, particularly the quantitative analysis. However, we are confident that, even with our least optimistic assumptions, the HCC will yield overall benefits compared to costs.

3.3 We estimate that the chosen option would generate a Net Social Present Value of £676m, with a corresponding BCR of 1.66.

3.4 Based on the analysis set out in this impact assessment (IA), as well as that of the related impact assessment on Financial Security, we have concluded that the updated CCMs better achieve the Relevant Objectives of the license and, therefore, should not be vetoed by Ofgem. This is set out in our decision letter.