Green Gas TASKFORCE

Green Gas Britain

Reducing the cost of Net Zero with biomethane

9 October 2025

Cadent
Your Gas Network

Reducing the cost of Net Zero with biomethane

Final Report

Green Gas Taskforce

October 2025

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Biomethane is a source of low-cost abatement that can play an important role in the energy transition

Context

- The UK decarbonisation pathway to reach Net Zero by 2050 will depend on a broad range of factors. Domestic and international policy, in addition to technology developments, will influence the role of electrification, the gas network and low-carbon fuels
- In the UK, while several policies and schemes have supported the development of the biomethane industry, biomethane production makes up a small share of gas supply
- Studies have highlighted the potential for biomethane production to scale significantly, while remaining competitive as a low-carbon alternative to fossil fuels. A transition pathway with a significant role for biomethane could utilise existing gas infrastructure, and de-risk the delivery of Net-zero

Objectives

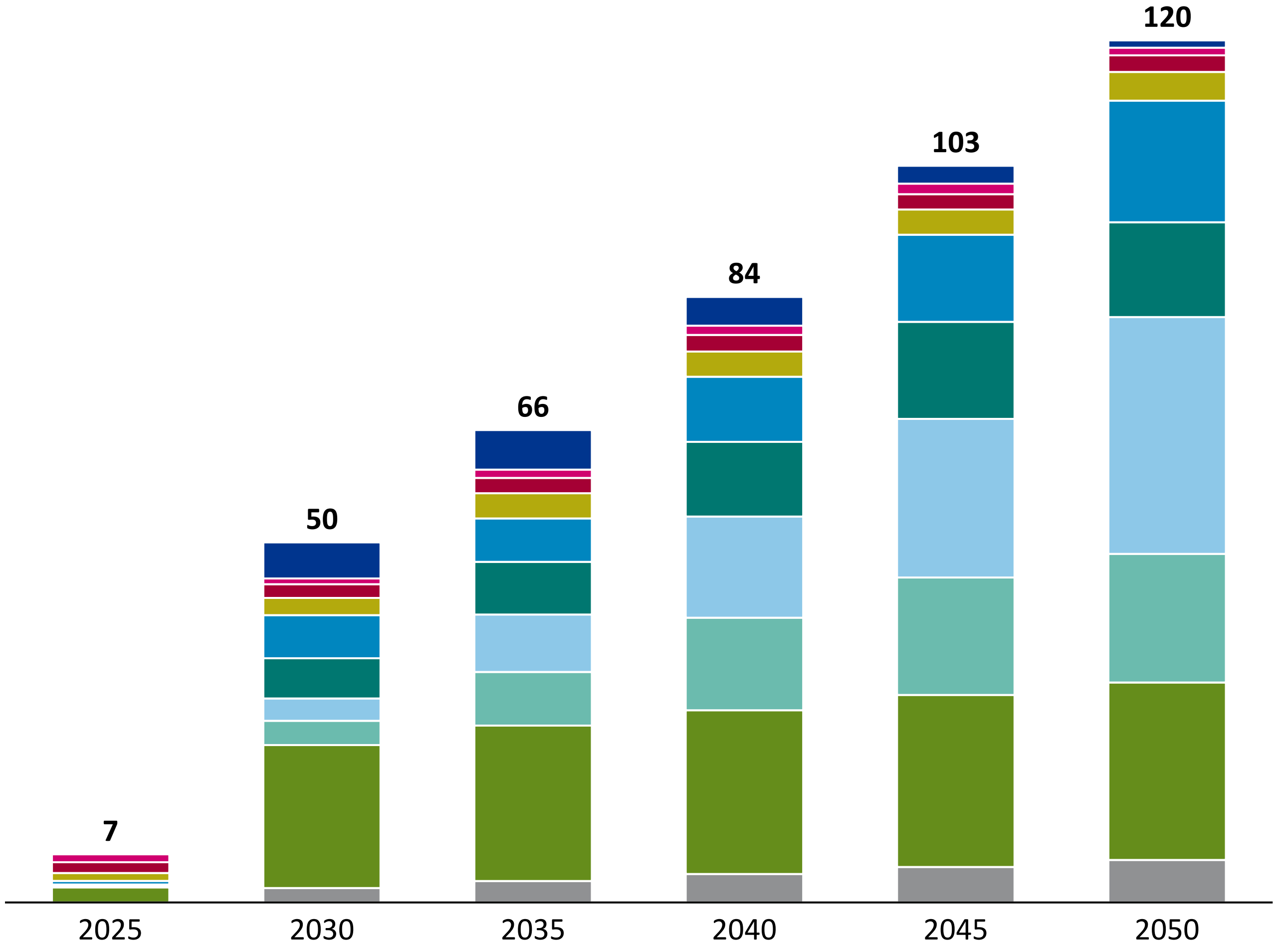
- On behalf of the Green Gas Taskforce, Baringa has assessed the potential role and benefits that a greater role for biomethane could deliver to the UK energy system as it transitions to Net Zero through three project phases:
    - Phase 1: Assessing Biomethane Production Economics
    - Phase 2: Establishing Biomethane's Value to the Energy System
    - Phase 3: Evaluating Policy Implications for Biomethane production

Conclusions

1. **Costs for a typical biomethane project could be reduced by 25%** if key barriers are overcome, with potential to also increase supplementary revenues. By 2050 typical biomethane projects could deliver GHG savings with an abatement cost below £200/tCO_2, meaning biomethane can offer a relatively low-cost option to reduce emissions
2. **Scaling up biomethane production from sustainable feedstocks reduces the cost of reaching Net Zero by c. £150-220bn**, with savings achieved in transport, as well as power generation, avoided electricity network investments, and decarbonisation of buildings
3. **Policy reform must prioritise the most cost-effective production of biomethane for GHG savings** while continuing to support production to begin to scale towards desired levels. Future policy should target reducing production costs, and enable greenhouse gas removals to realise the wider value of biomethane to support Net Zero

Independent studies have recently highlighted the potential to produce c. 120 TWh of biomethane from sustainable, domestic feedstocks, up from 7 TWh currently produced

Biomethane Feedstock Assumptions by Category, 2025-2050 (TWh biomethane)



	CAGR (25-50)	CAGR (30-50)
Landfill Gas	N/A	-8%
Food Waste	2%	2%
Sewage Sludge	2%	1%
Processing Wastes and Residues	5%	3%
Agricultural Residues	15%	5%
Livestock Waste	18%	4%
Grassland	23%	13%
Sequential Crops	N/A	9%
Rotational Crops	10%	1%
CHP Conversions	N/A	6%

Source: Alder Bioinsights 2025 Feedstock Study

Baringa has been engaged to assess the opportunity to reduce the cost of biomethane production as a solution to support Net Zero by 2050

Overview of Project Phases

Phase 1

Assessing Biomethane Production Economics

Leverage **internal cost modelling (Baringa LCOE Model)** and real-world data to assess private and system-level costs to 2050

Phase 2

Establishing Biomethane's Value to the Energy System

Utilise **systems modelling (ESME Model)** to test the hypothesis that investing in biomethane now could significantly reduce the system cost of delivering Net Zero by 2050

Phase 3

Evaluating Policy Implications for Biomethane production

Policy recommendations to enable greater biomethane production and further progress to Net Zero 2050

We have developed three scenarios to reach Net Zero by 2050 that explore potential cost reductions and value to the energy system with differing levels of progress

Overview of Baringa Cost Modelling Scenarios[1]

Model		Persistent Cost Barriers	Central Case	Barriers Overcome
		Biomethane costs decline slowly, and alternative technologies are more competitive	*Some efficiencies in biomethane costs as production grows to support an orderly transition*	*Biomethane costs reduce more quickly, and it is more competitive as an energy vector*
LCOE Model	**Feedstock production economics**	High production costs	Central costs	Low production costs
LCOE Model	**Biomethane production economics**	Higher plant costs	Central costs	Lower plant costs
LCOE Model	**Supplementary Revenue Streams**	5 £/t equivalent	10 £/t equivalent	15 £/t equivalent
ESME Model	**Decarbonisation pathways**	Delayed action	Central budget	Orderly action CCC 7th aligned
ESME Model	**Consumer technology costs (EV, heat pump, battery storage)**	-10% capex	Central costs	+10% capex
ESME Model	**Industrial Process Electrification**	10% increase in electrified process efficiency	Central expectation	No improvements in efficiency

Each scenario has a counterfactual, in which biomethane production volumes are limited to 2025 levels. We can then determine the benefit of higher biomethane volumes by comparing costs in the main scenario to costs in the counterfactual

1. LCOE Model Inputs from Phase 1 feed into ESME Model inputs in Phase 2

Source: Baringa LCOE Model, Baringa analysis

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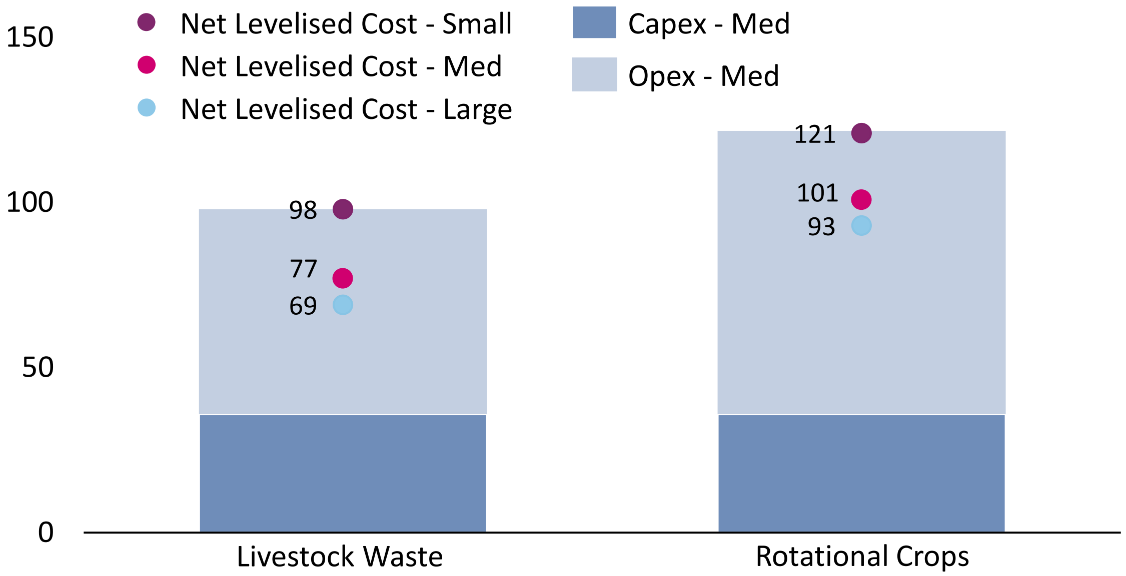
Production costs for a typical biomethane project could be reduced by 25% from current levels if key barriers are overcome

The average net levelised cost of biomethane for projects today is estimated to be approximately £90/MWh

Net Levelised Costs by Feedstock Type and Plant Size, 2025 (£/MWh)[1]



- Savings can be achieved through scale and AD plants in the UK are typically smaller than European counterparts such as Denmark
- While AD is a mature technology, greater deployment can yield efficiencies, with potential to reduce capex costs by c.10-20%

Reductions in project costs of more than £20/MWh and growth of revenue can increase biomethane competitiveness by 2050

Biomethane production costs and cost reduction potential to 2050 by category

		Description	Cost reduction potential[2]
Capex	Capital Expenditure	Up-front cost for AD plants, upgrading infrastructure	£12/ MWh
Capex	Grid connection	Costs of connecting to the grid	£1 / MWh
Opex	Other Operational Expenditure	Energy costs, site maintenance, and other	£4 / MWh
Opex	Feedstock	Ongoing costs to acquire feedstocks to feed AD plant	£2 / MWh
Opex	Propane	Ongoing costs to acquire propane for grid injection	£4 / MWh

- Today, a minority of projects secure additional revenues from digestate and captured biogenic CO_2
- CO_2 captured during production or combustion of biomethane can become a significant revenue driver, providing up to £50/MWh of revenue by 2050
- This could lead to average biomethane abatement costs of £200/tCO_2 by 2050

1. Plant size categories: Small = 60 GWh/year, Medium = 120 GWh/year and Large = 300 GWh/year. Net Levelised Cost includes capex and opex minus additional revenues 2. Barriers Overcome case for a Medium Livestock Waste project
Source: Baringa LCOE Model, Baringa analysis

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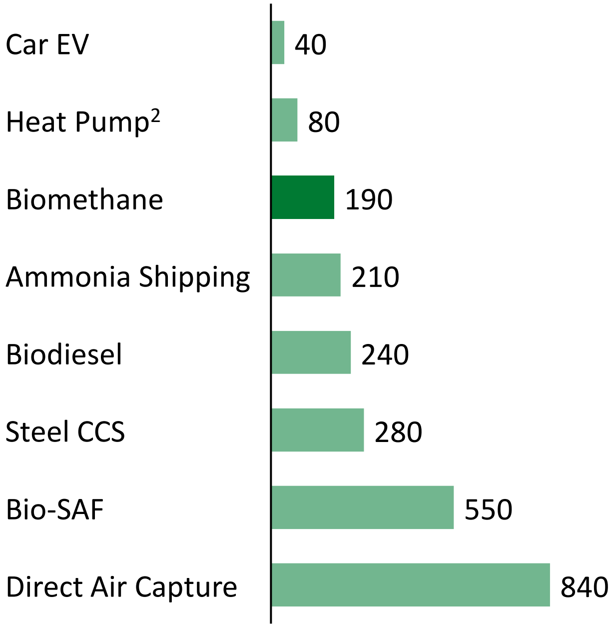
Biomethane delivers £174bn of cumulative savings to the energy system to reach Net Zero by 2050 in our Central Case

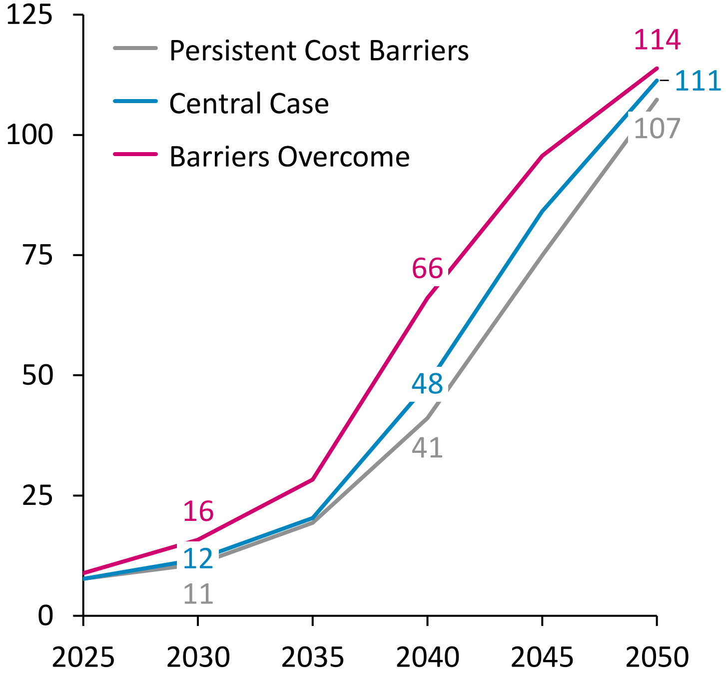
Biomethane presents a relatively low-cost solution to deliver GHG savings towards meeting Net Zero

Abatement costs of different technologies by 2050 (£/tCO_2)[1]



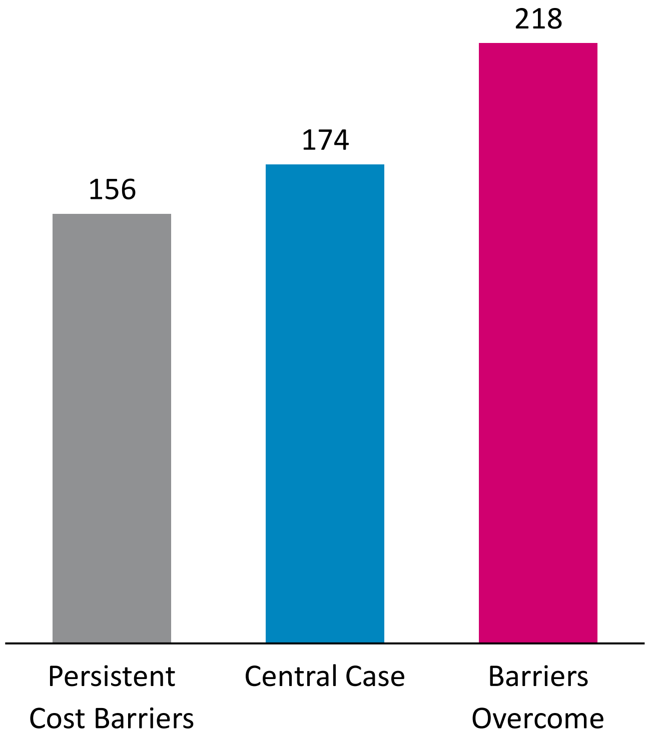
Biomethane production increases to more than 100 TWh in all scenarios considered

Biomethane production (TWh/year)



By addressing biomethane barriers faster, cumulative cost savings could reach £218bn by 2050

Cumulative Savings by 2050 (£bn)



1. 2050 abatement costs are uncertain, reported costs are Central Case assumptions 2. The abatement cost of Heat Pumps is for the unit cost only, assuming installation in a home with a good/excellent thermal rating (COP = 3), and does not include additional system costs

Source: Energy System Catapult's ESME model

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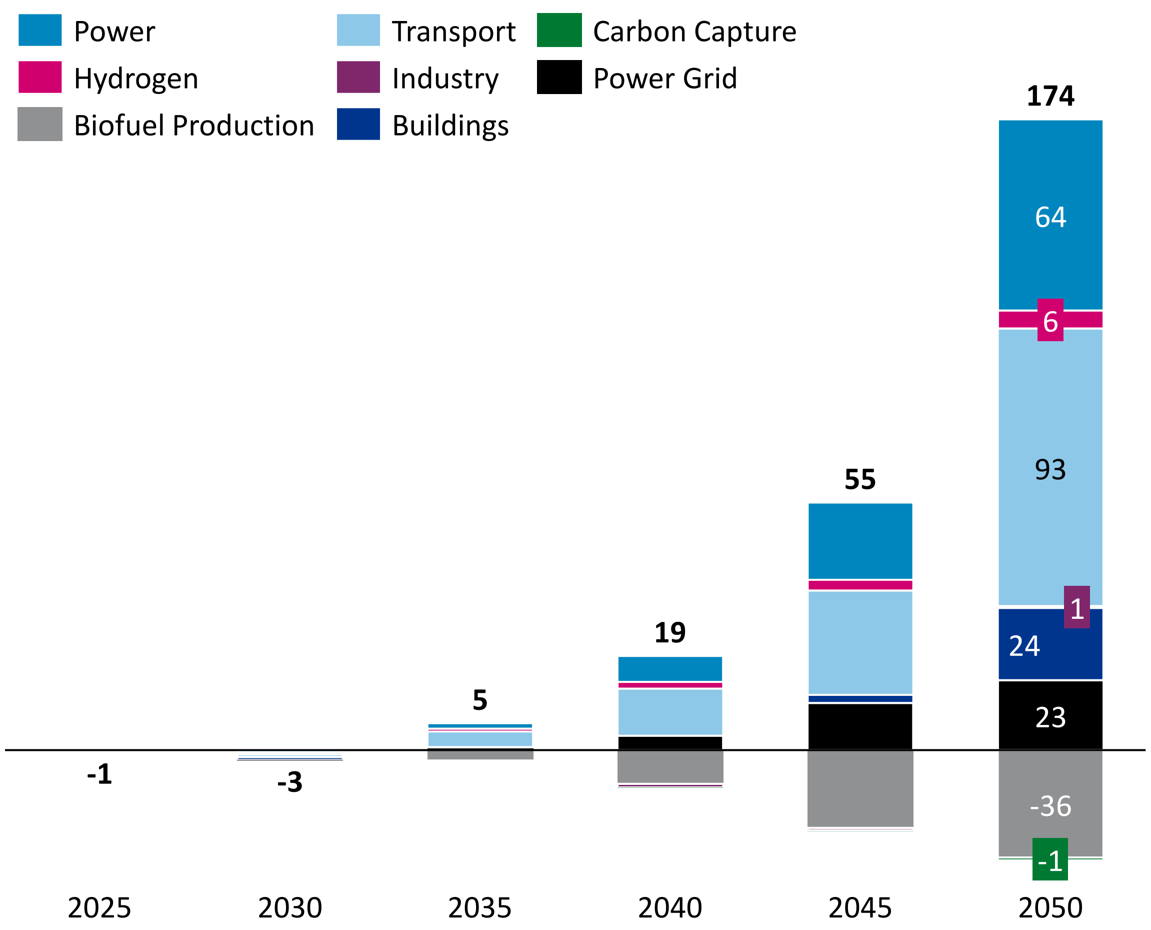
The £174bn cumulative saving in the Central Case is mostly achieved in transport, as well as power generation, avoided electricity network investments, and buildings

Cumulative System Cost Savings in our Central Case (£bn)



Key sectors	Commentary on savings from increased biomethane
Transport	Biomethane can deliver carbon removals, which allows for replacement of high-cost abatement options in hard-to-abate sectors such as aviation and HGVs,
Power	Reduced deployment of renewables, where additional build-out requires further costly system investment to manage variable risk from weather
Buildings	Preserving the use of gas boilers to deliver low levels of residual gas heating demand in the hardest-to-abate homes
Power Grid	Need for electrification gets deferred, thus reducing upfront power sector investment

Increasing the production of biomethane has benefits across the energy system. Biomethane provides cost-effective flexibility and reduces the costs of meeting peak demand. Greater biomethane avoids more costly abatement and means other technologies can be deployed at lower average-costs and with reduced supporting investments required

Source: Energy System Catapult's ESME model

Current policy fails to incentivise the most cost-effective GHG savings from sustainable feedstocks at scale

Principles for future policy design and performance of current Green Gas Support Scheme (GGSS)

Policy principles[1]	**Long-term certainty**	**Cost-effective GHG savings**	**Market-based**	**Compatibility**
Description	Establishes sufficient confidence among industry and investors to grow the market	Prioritises the most-cost effective feedstocks and production methods to deliver GHG savings	Enables the market to determine and deploy the most appropriate solution(s) to reduce costs, maximise GHG savings and enhance efficiency	Mitigate unintended distortions with domestic and international policies to maximise buyer confidence and value for money
Performance of current policy (GGSS)	**Requires amendment** Helps underpin new investments but currently restricted to greenfield projects and expires in March 2028, impacting development decisions now	**Fundamentally challenged** Tiered tariffs disincentivise scale and the minimum waste threshold constrains projects while failing to recognise sustainable, non-waste feedstocks	**Fundamentally challenged** Administratively-set tariffs run the risk of failing to accurately reflect the cost of new biomethane projects and create little incentive for competition among producers	**Requires amendment** Current policy treats biomethane as having equivalent emissions to fossil gas in the context of determining carbon costs linked to UK ETS

1. These design principles are well aligned to the Government's "Future Policy Framework for Biomethane Production: Call For Evidence" published April 2024 and their broader policies driving decarbonisation

We have set out nine recommendations to enable higher volumes of production, reduce production costs and realise the wider value of biomethane

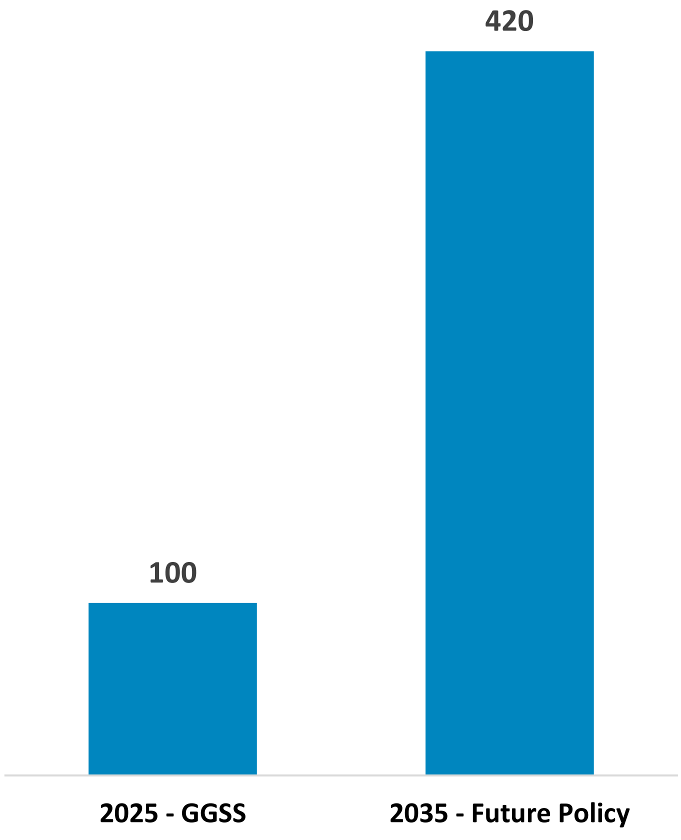
Overview of Policy Recommendations

Objective	#	Recommendation	Description
Enable higher volumes and cost reduction	1	Clarify Timeline	Clarify timelines for the Future Policy Framework and further **extend the current GGSS to avoid another hiatus**
	2	Future Support Mechanism	Design a policy mechanism which **supports cost-effective GHG savings** and helps facilitate a market for biomethane e.g., through a supplier obligation, without compromising sustainability
	3	Production Target	**Formalise a production target** of 20 TWh by 2035 to create a market for biomethane producers to fill the capacity gaps
	4	UK ETS recognition	**Recognise biomethane as zero carbon** in the UK Emissions Trading Scheme (ETS)
	5	Feedstock Evaluation	Evaluate the **sustainability of non-waste feedstocks** like rotational crops and subsequently broaden waste feedstock thresholds to recognise sustainable feedstocks with limited land use impact
Realising the wider value and supporting competitiveness	6	GGR Market	**Facilitate a market for Greenhouse Gas Removals (GGRs)** in the UK, incentivising cost-effective carbon removals from carbon captured via biomethane production and combustion
	7	Carbon Capture Access	Provide **access to CCS T&S infrastructure for all biomethane producers** who offer carbon capture
	8	Propanation Requirement	Either **reduce or remove** the need for propanation
	9	Digestate Market	**Establish a market for digestate** by creating demand support from the farming industry

By 2035, future biomethane policy support can be up to 60% more cost-effective than the current GGSS per unit of biomethane production supported[1]

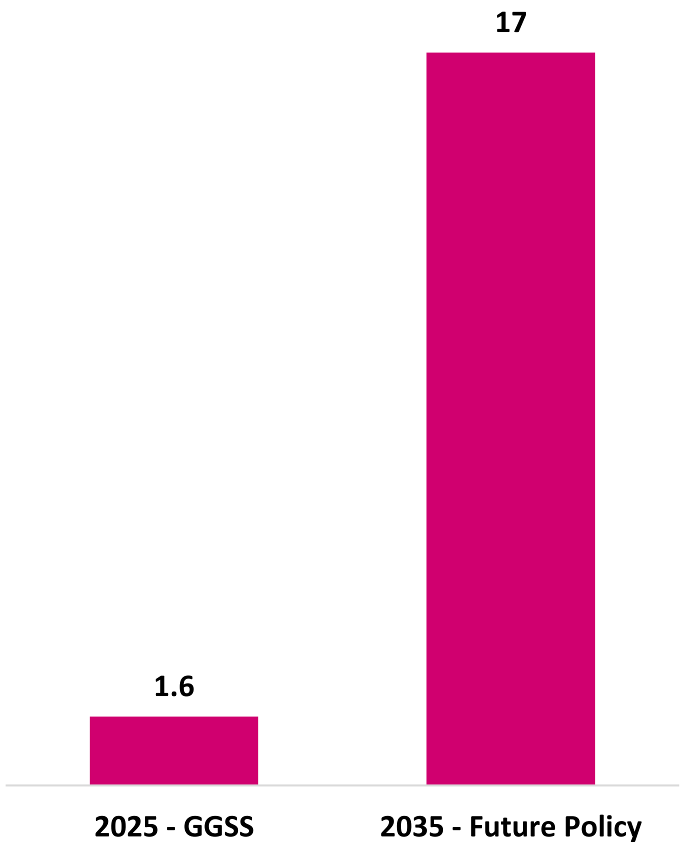
In the near term, continued policy support is expected to be required to scale production

Estimated biomethane support costs under current and future policy (£m/year)



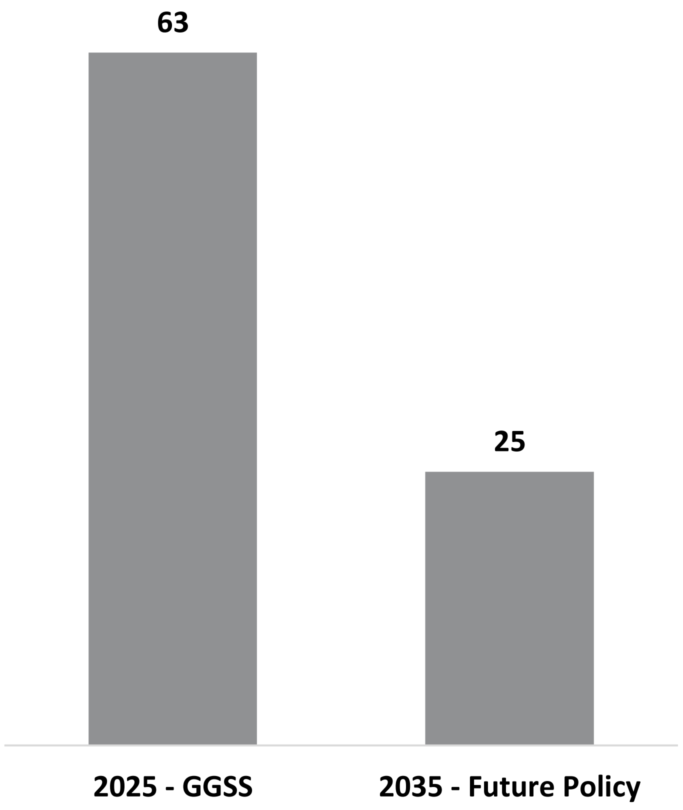
Policy needs to scale production capacity at a rate of 1.5-2/TWh per year to meet the target

Biomethane production supported under current and future policy (TWh/year)



With improvements in economics, required support per unit of production falls

Estimated support costs per unit of biomethane under current and future policy (£/MWh)



1. 17 TWh additional production supported by the new policy scheme in 2035 is aligned with the modelled optimal production increase from 2025 to 2035 in the Central Case scenario

Source: Baringa analysis

Several European comparators have already implemented some or all the recommended policy features and continue to see sustained market growth

Overview of biomethane policy landscape in comparable EU countries

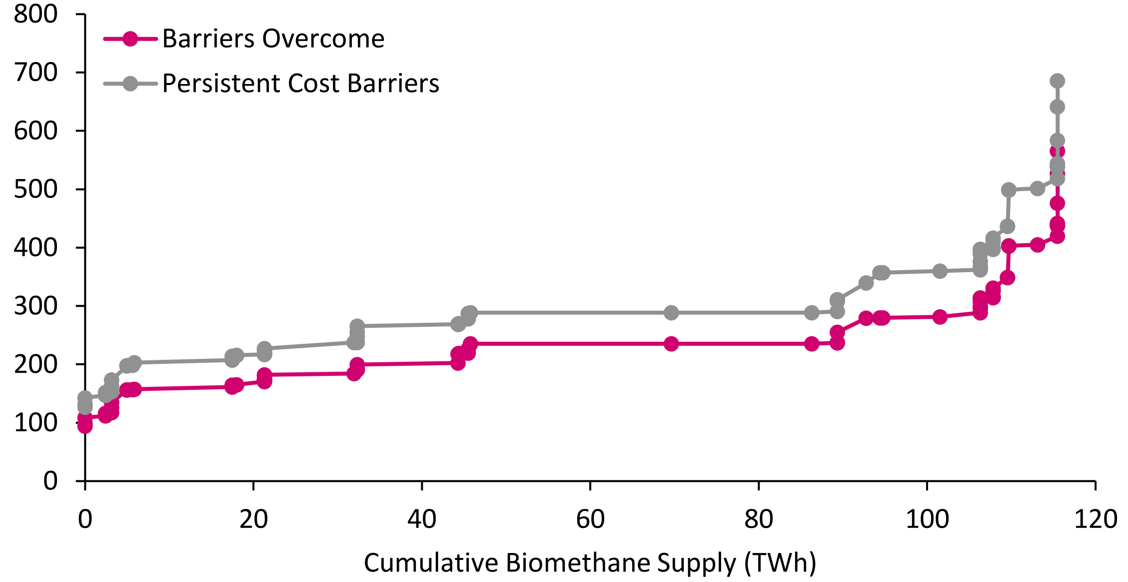
Description	High potential but limited growth in past years	Large and growing biomethane market	Large and growing biomethane market	Emerging market with incoming mandate	Market featuring large biomethane AD plants
Biomethane target	No	Yes	Yes	Yes	Yes
Propane requirement	Yes	No	No	No	No
Production support	Yes	Yes for small projects	Yes and competitively allocated	No	Yes and competitively allocated
Mandated demand in road transport	Yes	Yes	Yes with a minimum quota and floor price	Yes	No
Mandated demand in maritime	No	Yes	Yes	Yes	Yes
Mandated demand in gas blending	No	Yes	No	Incoming	No
ETS recognition	No	Yes	Yes	Yes	Yes
Sustainable crops[1]	No	Yes	Yes	Yes	Yes

1. Defined in Annex IX Part A of RED II

By 2050, if value delivered from enabling GGRs can be realised, direct support for biomethane production can be phased out

With Barriers Overcome, abatement costs could fall to less than £200/tCO_2 for 45 TWh and less than £290/ tCO_2 for 100 TWh

Biomethane Abatement Cost Curve 2050 (£/tCO_2)



Growing project scale and CCS uptake means biomethane can be produced without direct subsidy at GGR prices of £150/ tCO_2 or more

Summary of impacts of ETS and GGR prices on biomethane production that can be delivered without direct subsidy, 2050 Barriers Overcome scenario (TWh/year)[1]

UK ETS Price (Low → High) \ GGR price (Low → High)	£ 150	£ 200	£ 250	£ 300
£150	30	90	106	110
£125	21	45	106	110
£100	18	32	94	106
£75	17	21	45	106

- **GHG abatement cost example:** a biomethane project with a net production cost of 100 £/MWh and fossil gas equivalent revenues of 30 £/MWh would have missing money of 70 £/MWh. If the biomethane produced saves 0.183 tCO_2/MWh[1], the project would have a GHG abatement cost of c. 380 £/ tCO_2 (=70/0.183)
- **Abatement costs increase with biomethane production** because the most cost-effective feedstocks and projects are developed first. As output grows, producers move to more expensive or less effective options

1. Production without direct subsidy represents estimated volumes delivered at or below the projected price for fossil gas, assuming marginal unit of gas production faces UK ETS costs

Source: Baringa LCOE Model, Baringa analysis

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In this section:

- *What are the drivers of biomethane average, or levelised, production costs?*
- *What is the potential to reduce levelised biomethane production costs, considering capex, opex and alternative revenue streams?*
- *What carbon abatement cost could biomethane production deliver if cost savings are achieved?*

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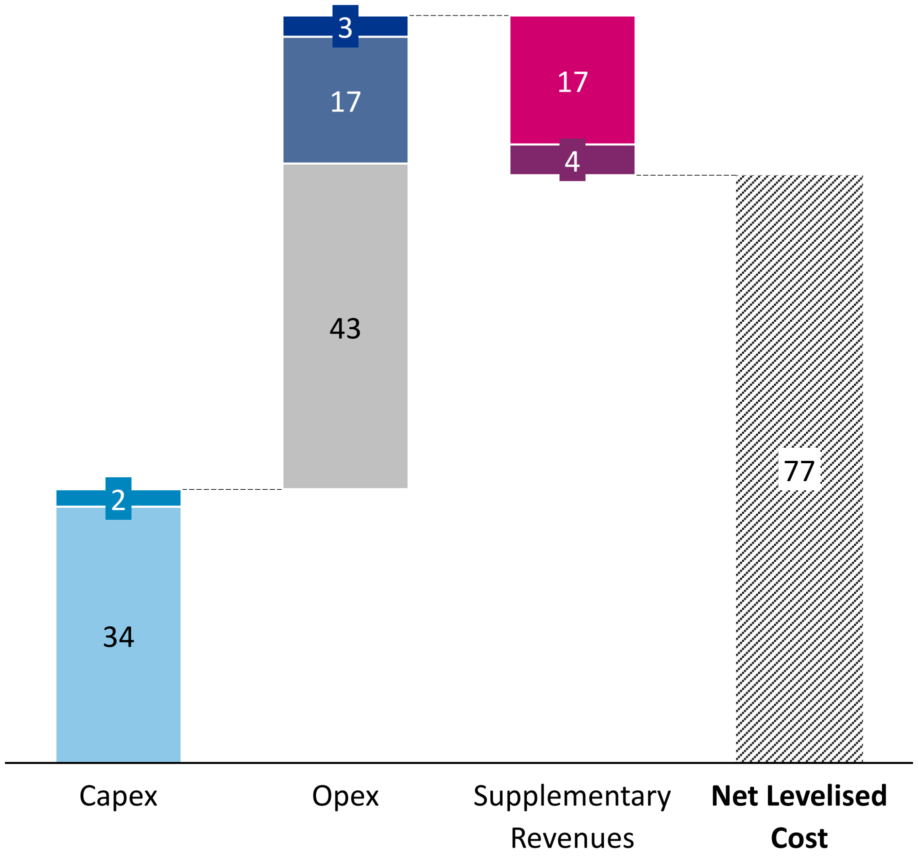
Plant size and feedstock type are key variables that affect the net levelised cost of biomethane production

Net Levelised Cost[1] of Biomethane Production by Components, 2025 (£/MWh)



	Description	Key variables
Capital Expenditure	Up-front cost to set up AD plants and upgrading infrastructure	• **Plant size** • **Feedstock type** • Location
Grid connection	Costs of connecting to the grid	• Type of grid connection • Distance to grid
Other Operational Expenditure	Energy costs, site maintenance, and other costs	• **Plant size**
Feedstock	Ongoing costs to acquire feedstocks to feed AD plant	• **Type of feedstock** • **Plant size**
Propane	Ongoing costs to acquire propane for grid injection	• **Plant size** • Propane costs • Required propane volume
RGGOs and/or biogenic CO_2	Sale of green credentials for biomethane or biogenic CO_2 (utilised or stored)	• **Plant size** • **Feedstock type** • Capture technology
Digestate	Potentially a cost for waste removal, or a revenue stream if sold as a byproduct	• **Plant size** • **Feedstock type** • Gate fees

1. Production example is based on a medium AD plant with CCS upgrader, processing livestock wastes

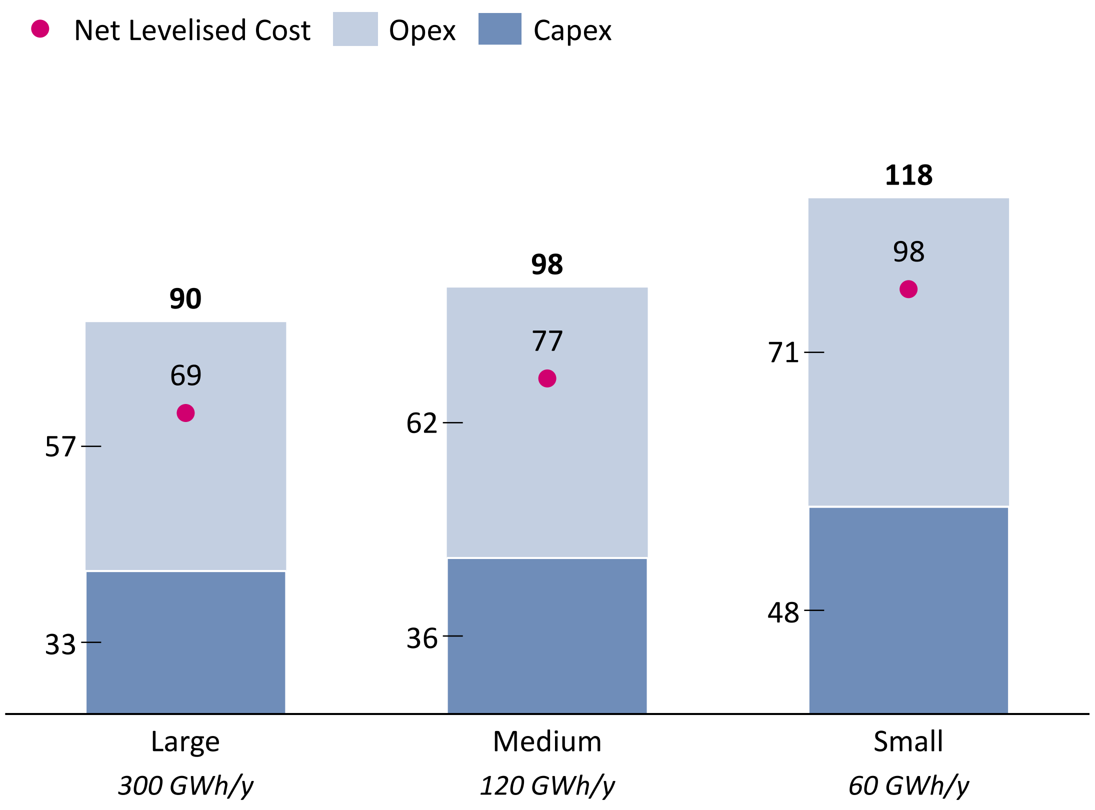
Source: Baringa LCOE Model, Baringa analysis

Production costs typically reduce as plant size increases, and waste feedstocks can be lower cost than dedicated crops if proximate to the production site

Net Levelised Costs by Feedstock Type and Plant Size, 2025 (£/MWh)

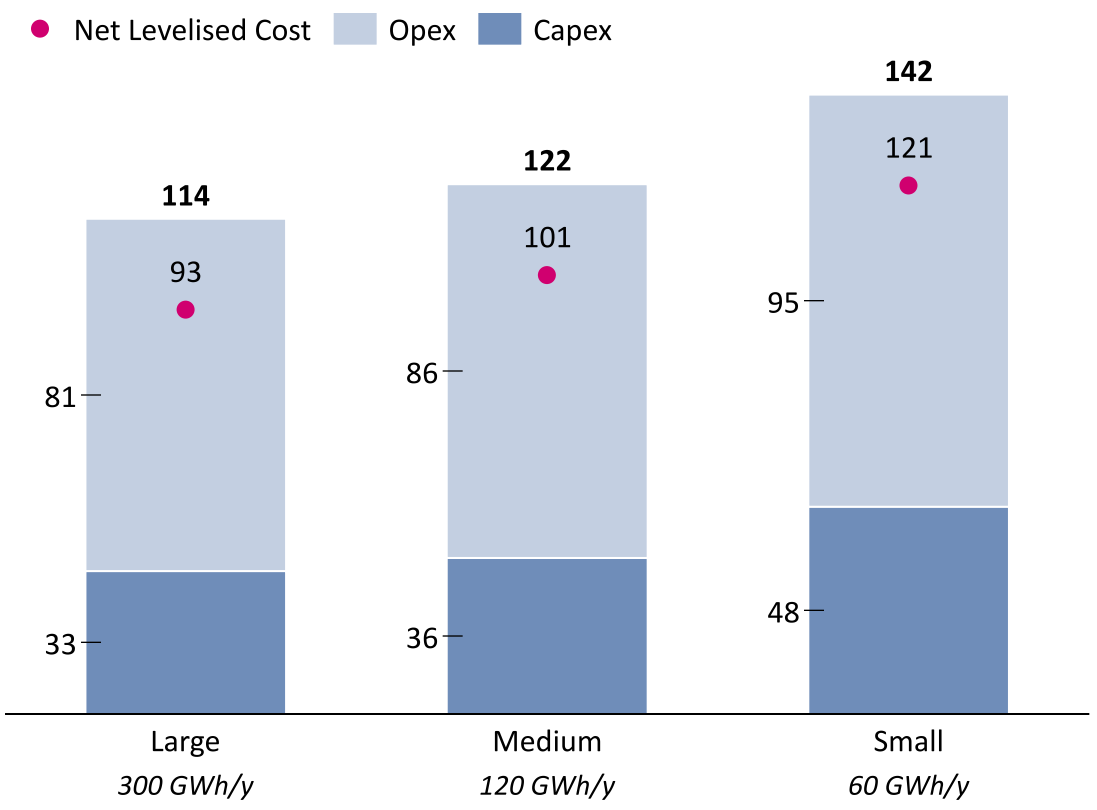
Livestock waste is the lowest-cost feedstock available, which results in lower opex across the plant sizes

Livestock Waste



Rotational crops are comparatively expensive, but have potential to achieve scale more easily given feedstock logistics[1]

Rotational Crops



1. Wet manures are costly to transport over longer distances, given its high liquid content, whereas crops are more easily transported and stored

Source: Baringa LCOE Model, Baringa analysis

Production costs for a typical biomethane project could be reduced by £26/MWh if key barriers are overcome, with potential to also increase supplementary revenue

Biomethane Production Barriers by Cost / Revenue Components

	Current challenges	Options to address	Cost reduction potential[1]
Capital Expenditure	• Scale influenced by **subsidy design** and **limited standardisation** in plant design	• **Increased scale** and **learning** through increased deployment	£12/ MWh
Grid connection	• **Connections process** contributes to project risk	• More **ambitious and consistent standards** for timeliness of connections approval	£1 / MWh
Other Operational Expenditure	• Energy costs, site maintenance, and other costs		£4 / MWh
Feedstock	• Limited supply of high energy density feedstock with **recognised sustainability credentials**	• Evaluate the sustainability of rotational/sequential crops to align with EU standards • Update policy to prioritise the most cost-effective sources of GHG savings	£2 / MWh
Propane	• **Regulation** for grid injection requires propane to be added to biomethane	• Remove/reduce propane requirement through revised regulation and improved monitoring	£4 / MWh
RGGOs and/or biogenic CO_2	• **Buyer confidence** impacted by exclusion from UK ETS and GHG Protocol • **Nascent market for CO_2** storage	• Accept biomethane as a zero-carbon fuel in UK ETS • Accelerated visibility on process for biogenic CO_2 storage	See subsequent slides
Digestate	• **Nascent market** with **regulatory barriers**	• Low carbon fertiliser standard and improved homogeneity of digestate quality across projects	See subsequent slides

1. Using the Barriers Overcome case for a Medium Livestock Waste project

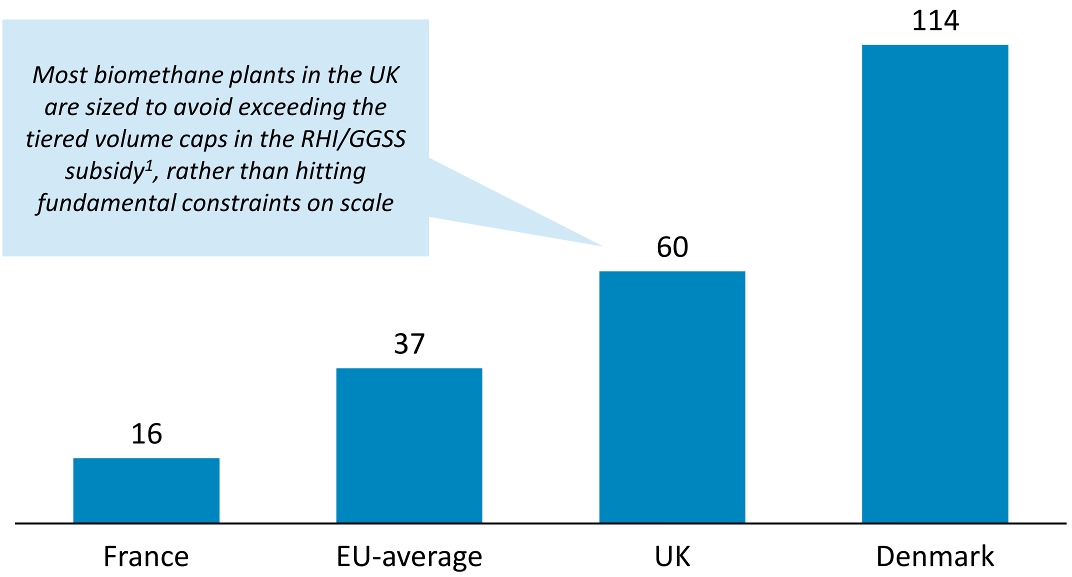
Source: Baringa LCOE Model, Baringa analysis

Increased scale and learning rates could reduce average production costs from capital expenditure by £12.5/MWh

Overview of Potential Capex Savings

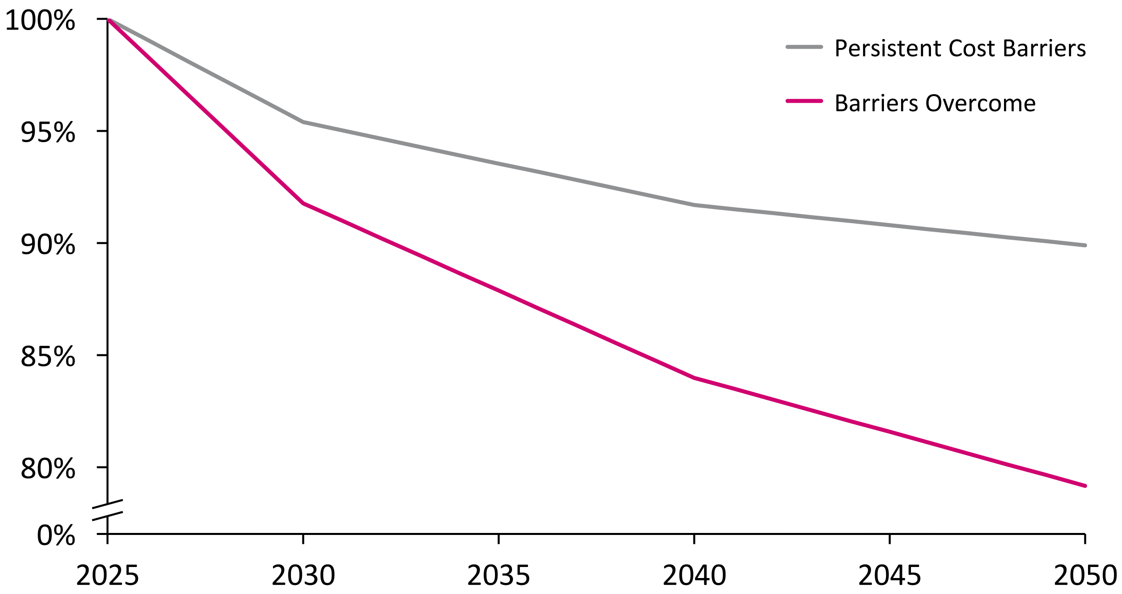
Savings can be achieved through scale and AD plants in the UK are typically smaller than European counterparts such as Denmark

Average Biomethane Project Capacity, 2025 (GWh/annum)



While AD is a mature technology, greater deployment can yield efficiencies, with potential to reduce capex costs by c.10-20%

CAPEX Learning Rate by Scenario, 2025-2050 (Index, 2025 = 100%)



Total capex savings in 2050 could range from **£12.5 / MWh** (Barriers Overcome) to **£8.0 / MWh** (Persistent Cost Barriers Case – which assumes lower potential for improvements)

1. Higher 'Tier 1' payments were made to the first 40 GWh for the RHI and 60 GWh for the GGSS, with reduced 'Tier 2' payments for additional volumes up to an additional 40 GWh for the RHI and GGSS, with lower 'Tier 3' payments made up to a total injection volume of 250 GWh

Source: Baringa LCOE Model, Baringa analysis, Argus

Reducing reliance on propane provides the largest operational cost savings - around £4/MWh

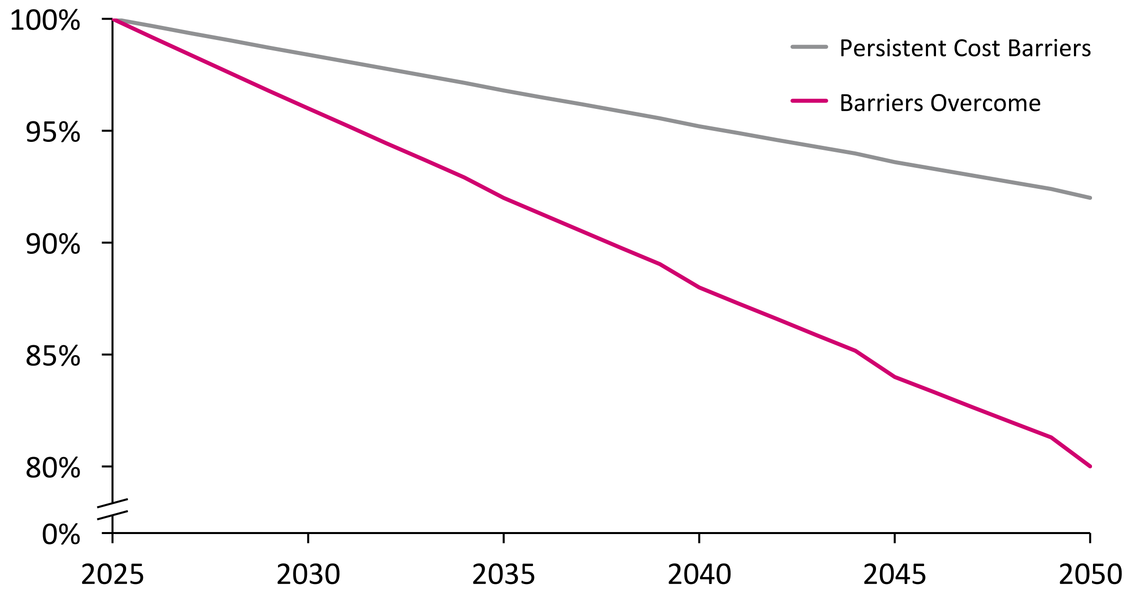
Overview of Potential Opex Savings

Regulatory change could deliver production cost savings by replacing propane enrichment with more cost-effective solutions

- Current regulations around the characteristics of gas injected into the network mean that propane must be injected to enrich this green gas.
- In future, regulatory changes could allow for the deployment of new technologies, like bidirectional flow metering, could help lower the amount of propane needed for enrichment
- Adding propane adds significantly to the cost of producing biomethane and reduces the overall carbon abatement offered. Reducing or eliminating the need for propanation of biomethane before injection could reduce production costs by an average of 5%

Greater deployment can yield operational efficiencies which, with energy efficiency improvements can reduce opex costs by c.8-20%

OPEX Learning Rate by Scenario, 2025-2050 (Index, 2025 = 100%)[1]



Total average opex savings in 2050 could range from **£9.5 / MWh** (Barriers Overcome) to **£3.5 / MWh** (Persistent Cost Barriers – which assumes lower potential for improvements)

1. The opex learning rate excludes the impact of removing propanation requirements

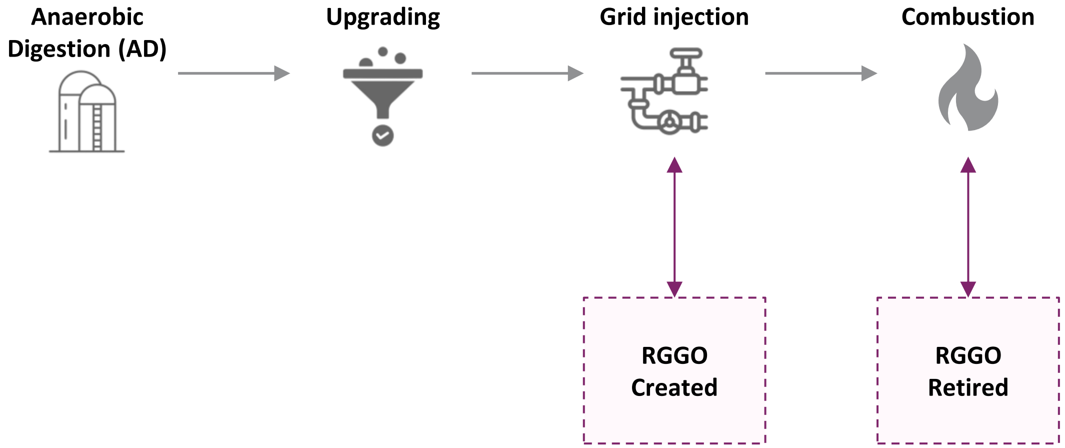
Source: Baringa LCOE Model, Baringa analysis

UK producers currently receive c. £7/MWh from RGGO sales, where the value is driven by voluntary purchasing

RGGOs as a value driver

RGGOs enable end consumers to disclose that their associated gas consumption is renewable

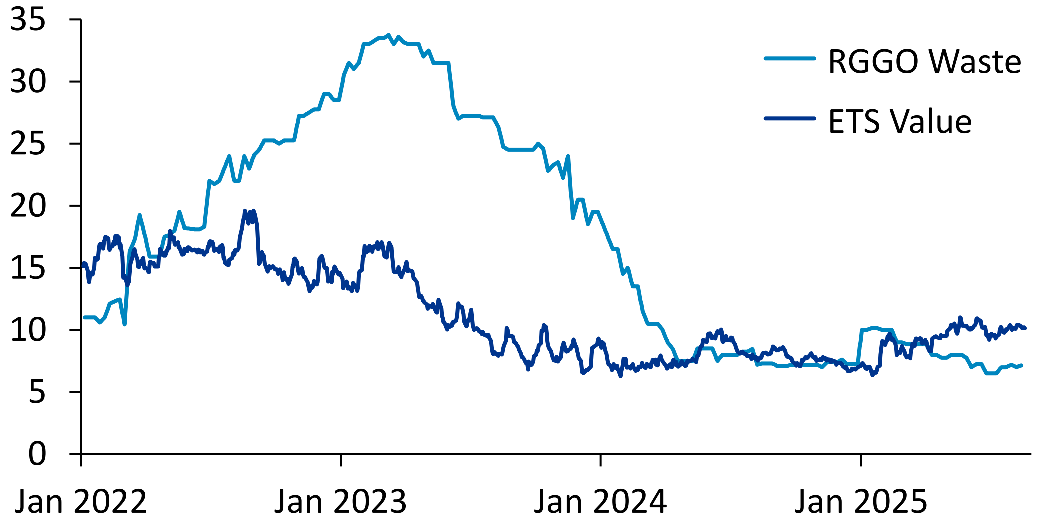
Biomethane value chain and RGGOs



- Renewable Gas Guarantees of Origin (RGGOs) provide assurance to an end consumer that the volume of gas they are consuming with RGGOs is renewable
- An RGGO is created when one unit of biomethane is injected into the grid, and a consumer 'retires' the RGGO when they wish to claim renewable gas consumption, helping to prevent double counting of green attributes

RGGO prices tracked UK ETS over the past 18 months but biomethane is not treated as zero carbon in the UK ETS

Historical UK waste-based RGGO prices (£/MWh)



- UK RGGO prices for waste-based biomethane have tracked the equivalent value for offsetting natural gas emissions in the UK ETS over the past 18 months, despite not being a viable offset in the scheme[1]
- UK RGGO prices have historically been observed at a premium to the ETS equivalent value, driven by voluntary willingness to pay for green attributes

1. From early 2022 to early 2024, high fossil gas prices drove higher willingness to pay for RGGOs which was reflected in the raised prices observed

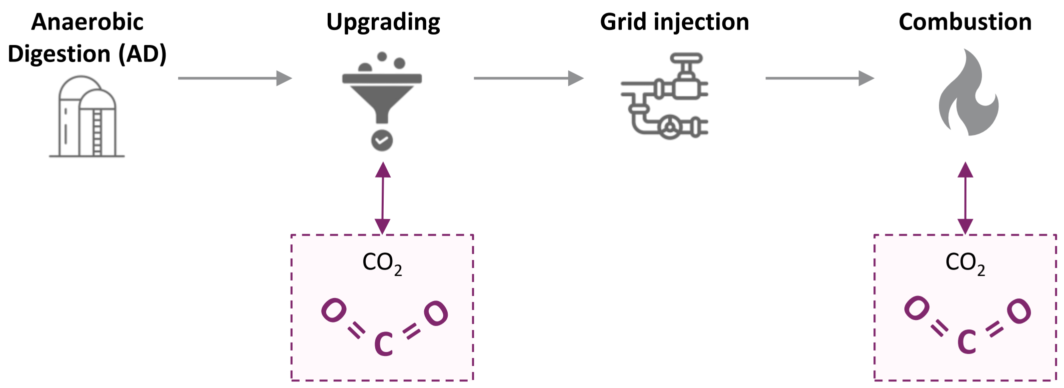
Source: Argus, Baringa analysis

Biogenic CO_2 could be captured and stored to produce GGRs which emitters, typically in hard-to-abate sectors, can purchase to offset their emissions

GGR production from biogenic CO_2

There are two opportunities to capture biogenic CO_2 from the biomethane value chain

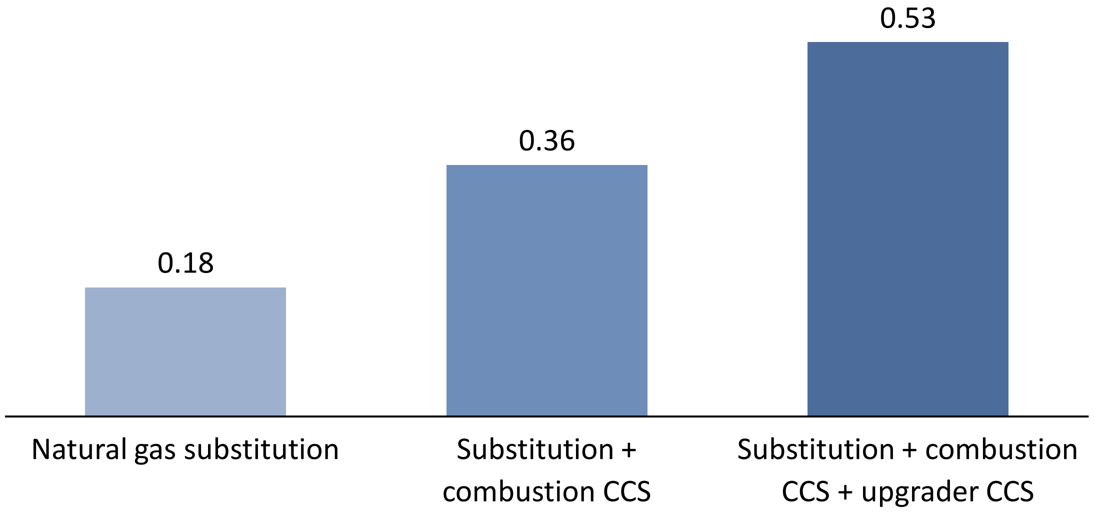
Biomethane value chain and CO_2 sources



- Biogenic CO_2 can be captured from the upgrading process when converting biogas into grid-quality biomethane and/or from the point of combustion of the biomethane

Biogenic CO2 can be captured and stored to increase the GHG savings per physical unit of biomethane and generate GGRs

GHG savings through different CCS pathways (tCO_2/MWh)



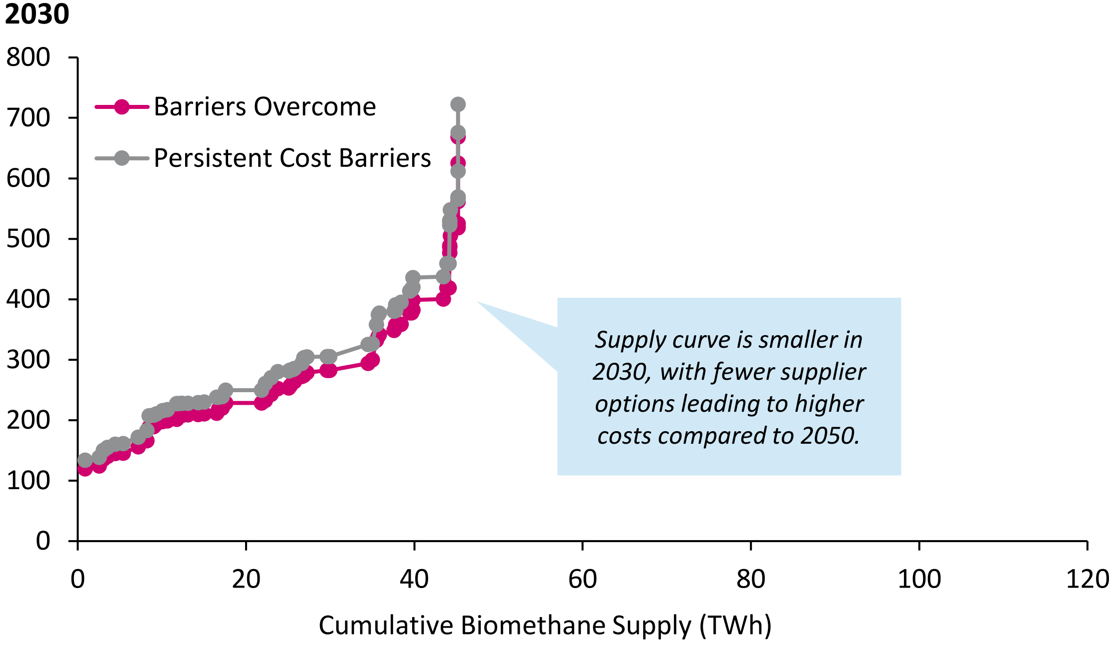
- Biogenic CO_2 which is captured and permanently stored generates net carbon removals, which are monetised via Greenhouse Gas Removal (GGR) certificates, and can be used to offset emissions elsewhere across the economy

Source: Baringa analysis

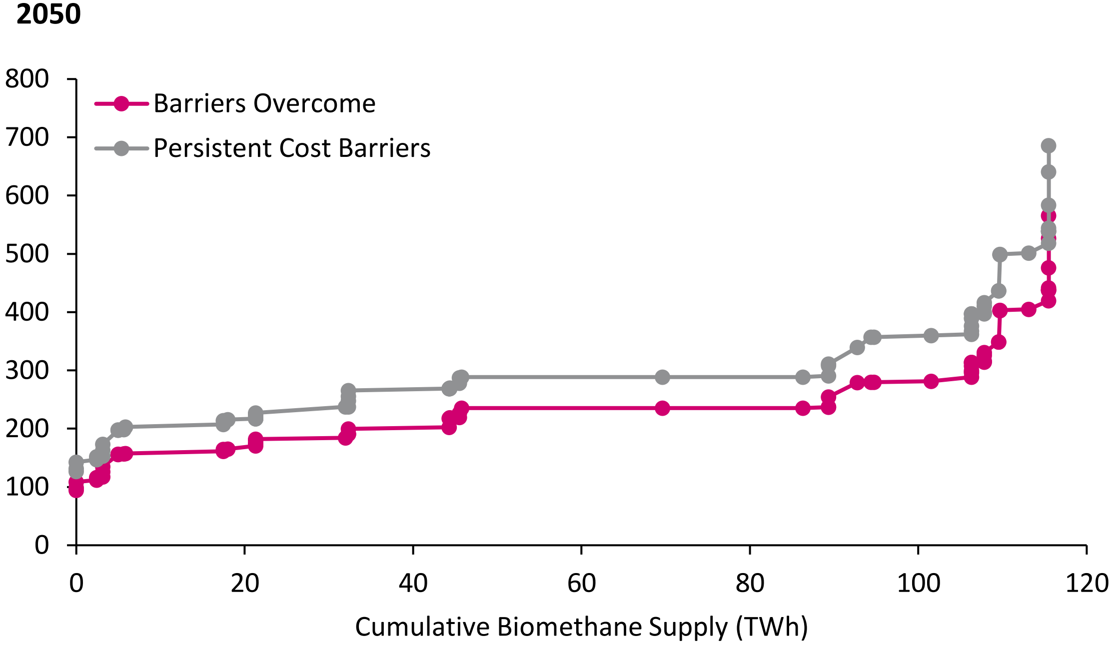
Through reduced production costs with Barriers Overcome, typical biomethane projects could deliver GHG savings with an abatement cost below £200/tCO_2

Biomethane Abatement Cost Curves (£/tCO_2)[1]

In 2030, typical GHG abatement costs are expected to be in the range of 200 to 300 £/tCO_2



With Barriers Overcome, this could fall to less than £200/tCO_2 for 45 TWh and less than £290/tCO_2 for a further 62 TWh by 2050



- **GHG abatement cost example:** a biomethane project with a net production cost of 100 £/MWh and fossil gas equivalent revenues of 30 £/MWh would have missing money of 70 £/MWh. If the biomethane produced saves 0.183 tCO_2 /MWh, the project would have a GHG abatement cost of c. 380 £/ tCO_2 (=70/0.183)
- **Abatement costs increase with biomethane production** because the most cost-effective feedstocks and projects are developed first. As output grows, producers move to more expensive or less effective options

1. Assumes fossil gas price of £27/MWh

Source: Baringa analysis

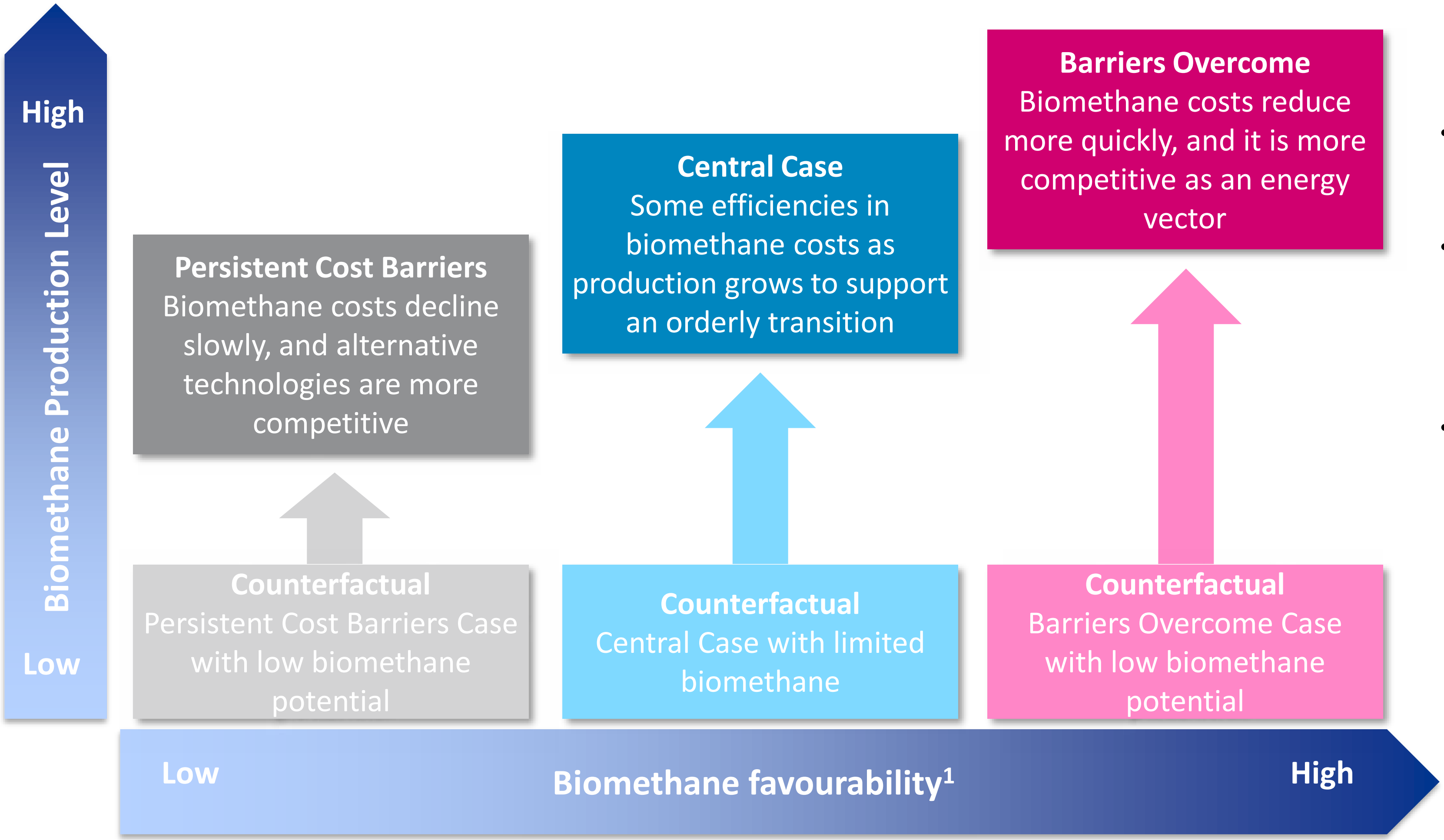
Table of contents

In this section:

- *How have we assessed the system value of biomethane, and what scenarios have we used?*
- *What is the optimal level of biomethane production that could minimise the costs of reaching Net Zero?*
- *With greater biomethane, what savings can be achieved for the UK to reach Net Zero?*
- *What are the implications for gas usage in 2050, and for household bills?*

Each of our defined scenarios includes a counterfactual, in which UK biomethane production is assumed to remain at today's levels of 7 TWh

Summary of scenarios and their counterfactual cases



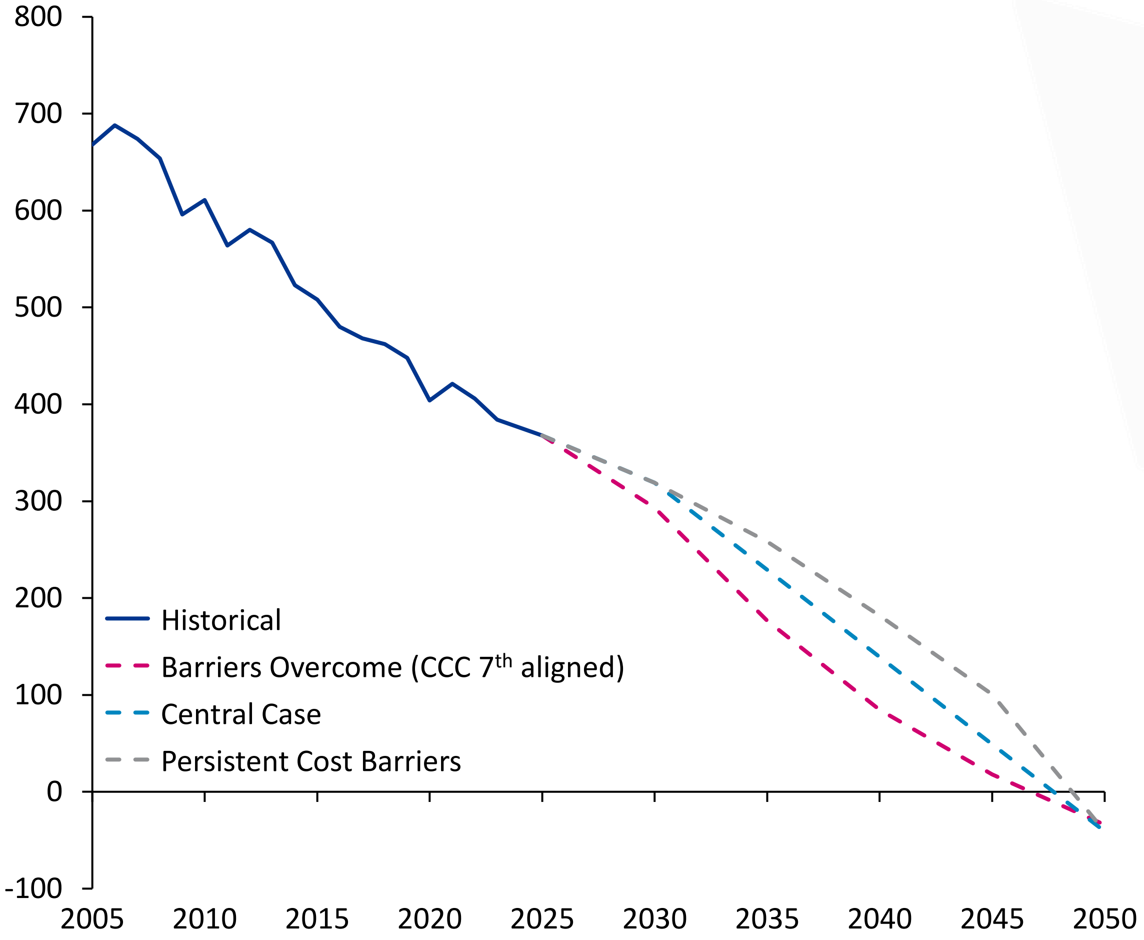
- There is a corresponding counterfactual to analyse the impact of additional biomethane supply for each scenario
- Counterfactual scenario assumptions remain the same as their corresponding scenarios, except that biomethane production volume are limited to 2025 levels
- This scenario structure allows us to test the hypothesis presented across a range of assumptions that may influence the lowest cost path for decarbonisation

1. Assumptions vary across scenarios. The combination of assumptions is expected to be most supportive of the value case for biomethane in the Barriers Overcome scenario and least favourable in the Persistent Cost Barriers Case

Source: Baringa analysis

Policy, in addition to technology developments, will influence the combination of electrification and low-carbon fuels that drive UK decarbonisation

Scenarios for UK energy system emissions pathway to Net Zero[1] (MtCO$_2$/Year)



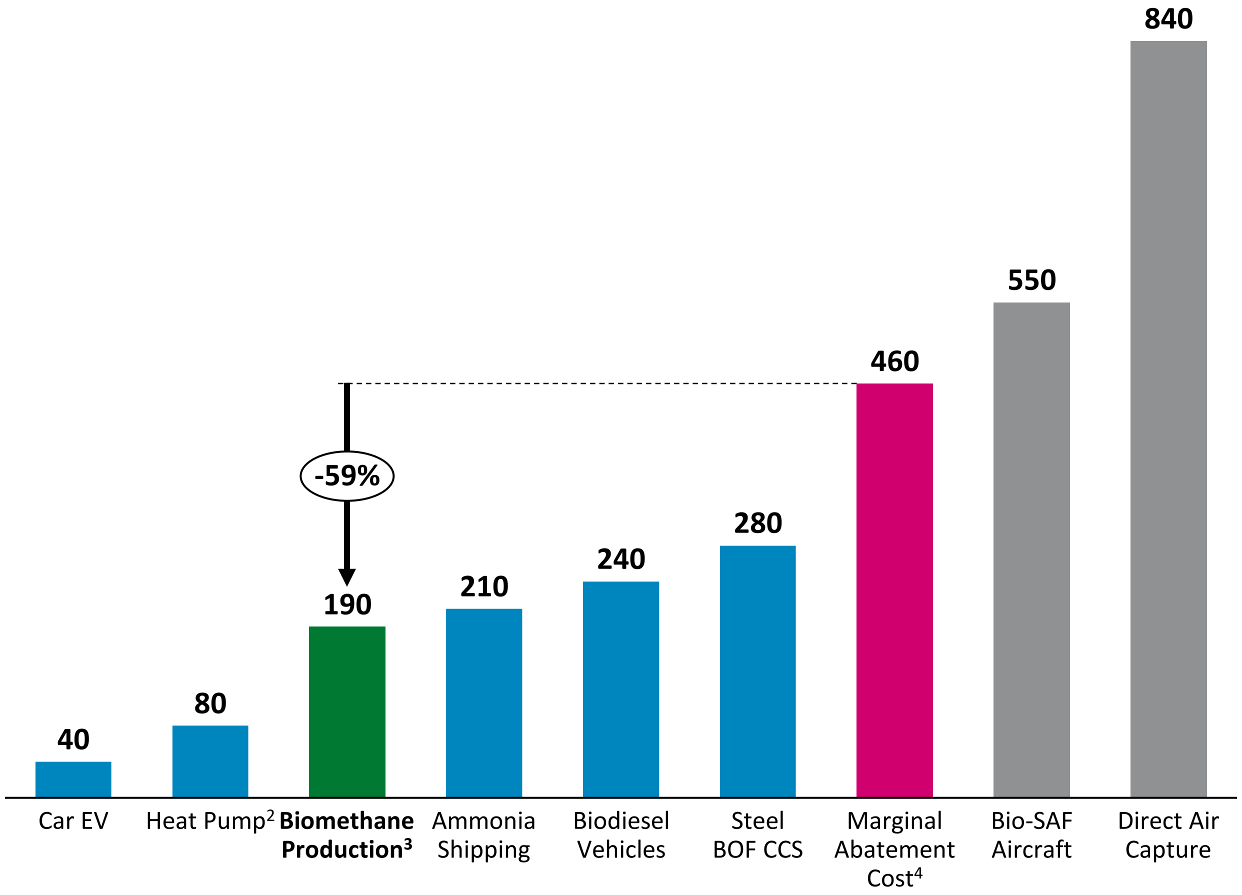
The pace of decarbonisation is one potential driver of the case for, and timing of, scaling biomethane production

- Our modelling approach assesses the impact of varying ambition regarding the pathway to Net zero, in addition to testing supply and demand sensitivities, and varying the cost profile of biomethane against alternatives.
- The carbon budget pathway informs the extent to which the system must invest to meet the emissions target imposed. A more stringent budget will induce a higher carbon price, benefiting transition technologies and fuels such as biomethane.
- The **Central Case** requires steady progress to reach Net Zero
- In the **Barriers Overcome** scenario, the pathway is guided by the CCC 7th carbon budget, and represents an orderly, lowest risk transition.
- While a more restricted carbon budget is expected to generate high carbon prices sooner in the pathway, this will benefit the early adoption of biomethane.
- In the **Persistent Cost Barriers** scenario, the pathway represents a 'delayed transition'; a high-risk case reflecting assumptions used by NGFS[2] and other institutional bodies to assess the potential economic impacts and financial risks associated with climate change.
- This is likely to result in higher volumes of fossil fuels persisting for longer, so the case for biomethane may be less clear.

1. Net zero pathways for the overall economy include an assumption that the energy system reaches net negative emissions by 2050. This can offset residual positive emissions elsewhere in the economy
2. Network for Greening the Financial System

We have evaluated the role and value of biomethane in delivering a cost-optimal Net Zero pathway for the GB energy system

Abatement costs of different opportunities compared to biomethane, 2050 (£/tCO_2)[1]



Modelling defines the cost-optimal mix of technologies to achieve the Net Zero pathway in each scenario

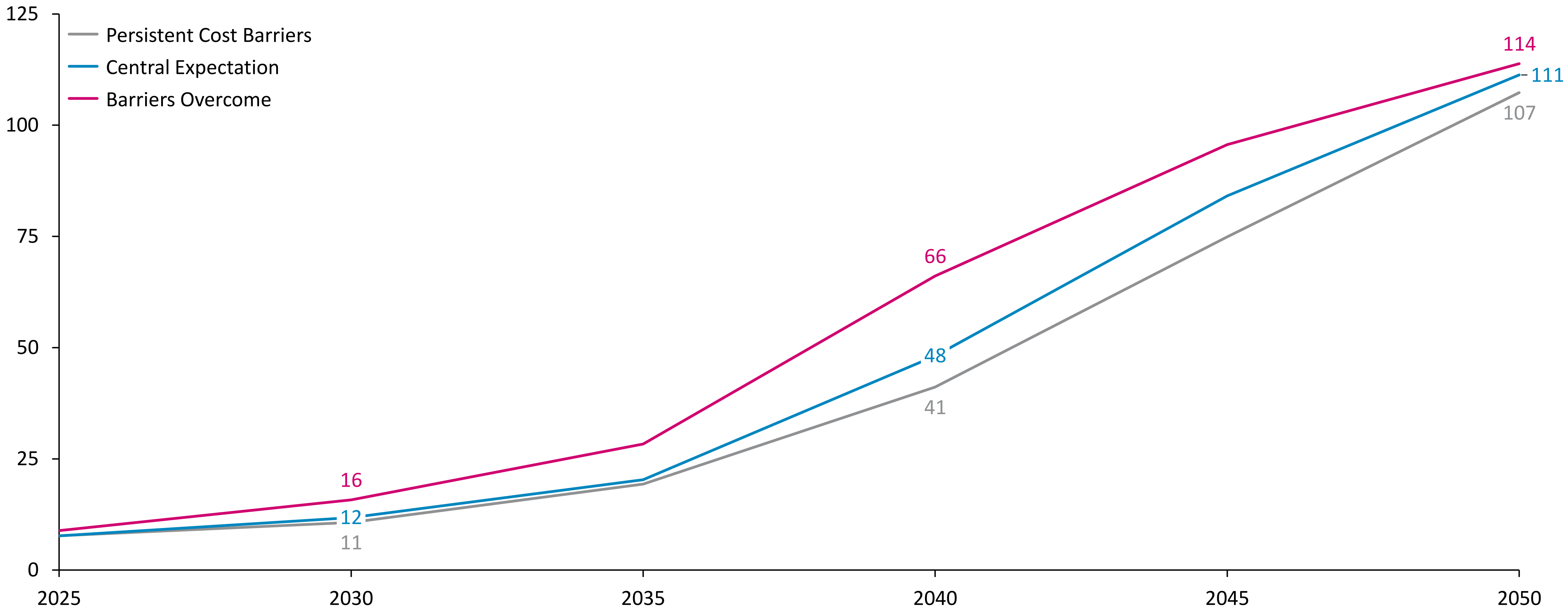
- To evaluate biomethane's role in delivering Net Zero, we use system modelling, which employs an optimisation approach to determine the least cost combination of different technologies that will meet energy demand and ensure compliance with the carbon budget
- This means for aircrafts, it would cost >£500/tCO_2 vs the marginal cost of £460/tCO_2, making it a relatively higher cost abatement, and rendering biomethane a more attractive abatement option at £190/tCO_2
- However, when compared to options like heat pumps and electric vehicles, biomethane is a more expensive option, but these alternatives have limitations over the horizon for where they can be competitively deployed, after wider system investments and impacts are accounted for

1. This is a simplification for purpose of visualisation and does not represent wider system impacts like network build for example
2. The abatement cost of Heat Pump is for the unit cost only, assuming installation in a home with a good/excellent thermal rating (COP = 3), and does not include other system costs.
3. Approximate abatement cost for the first c. 45 TWh of biomethane deployed in Barriers Overcome
4. This is the modelled 'shadow' carbon price derived in Phase 2 energy system modelling and reflects the estimated cost of the marginal unit of carbon abatement required to meet Net Zero at lowest cost for the system

Source: Energy System Catapult's ESME model, Baringa analysis

Biomethane production increases to more than 100 TWh in all scenarios considered

Biomethane production (TWh/year)



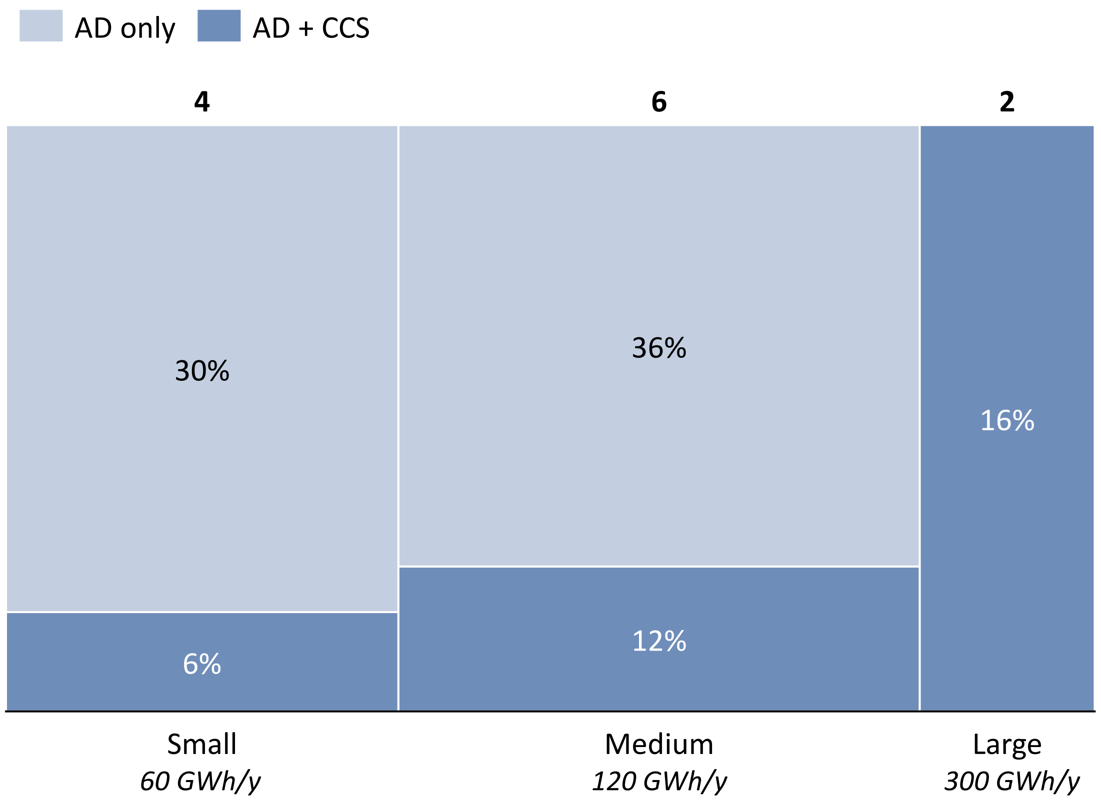
Source: Energy System Catapult's ESME model

Biomethane production mainly originates from medium scale projects in 2030, shifting to large projects with CCS by 2050

Biomethane production by AD Asset Type (TWh/year) and share of total in-year production - *Central Case*

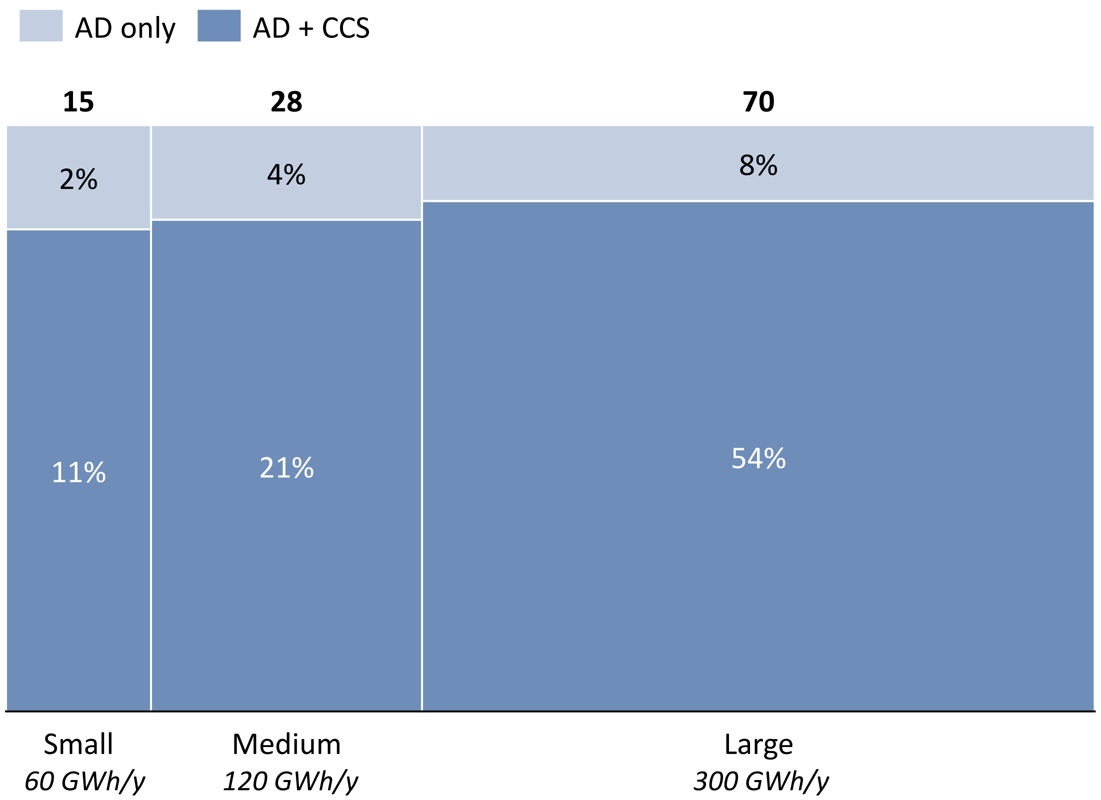
Total biomethane production is c.12TWh in 2030, with c.66% driven by small and medium plants without CCS

2030



By 2050, most production is from large projects, with 86% of projects having CCS

2050



1. In the medium term, the modelled growth in biomethane production capacity is constrained by AD build-rates, rather than feedstock capacity

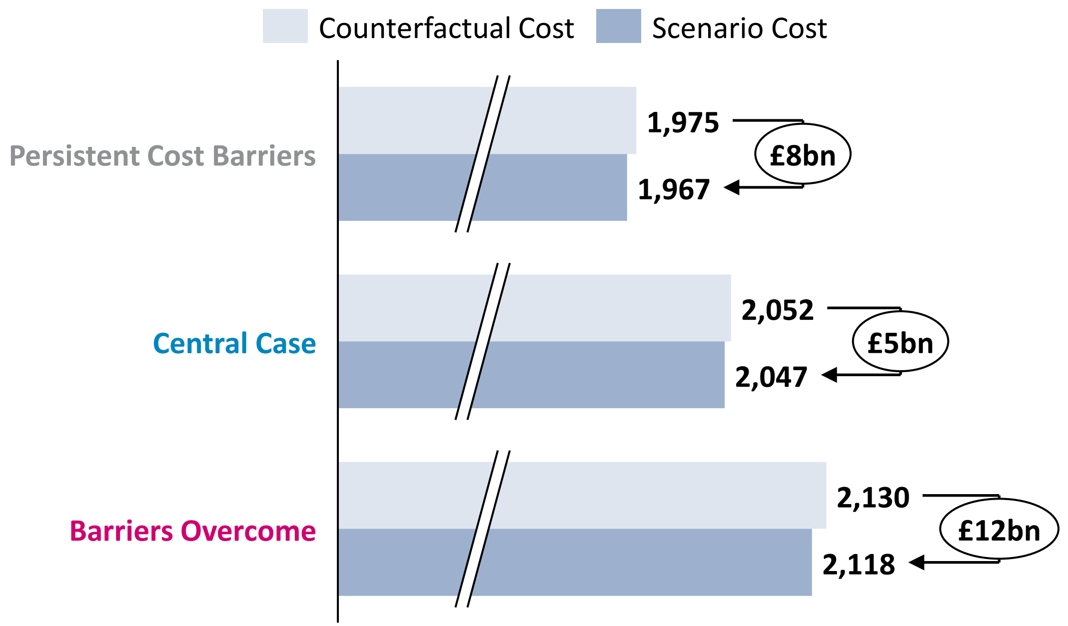
Source: Energy System Catapult's ESME model, Baringa analysis

Biomethane generates a cumulative saving of c. £160bn with Persistent Cost Barriers by 2050, which can be increased to c. £220bn in the Barriers Overcome scenario

Costs and Cumulative Savings by Scenario (£bn)

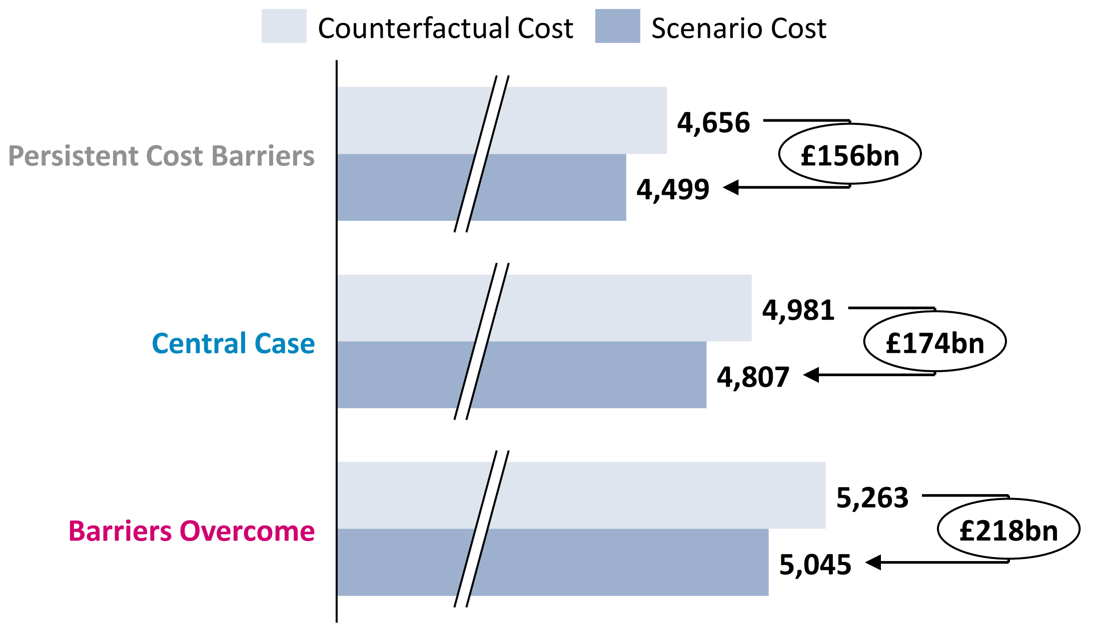
In the medium term, c.£5-9bn savings can be generated across the three scenarios

2035



By addressing biomethane barriers faster, cumulative cost saving to reach Net Zero can reach £218bn

2050

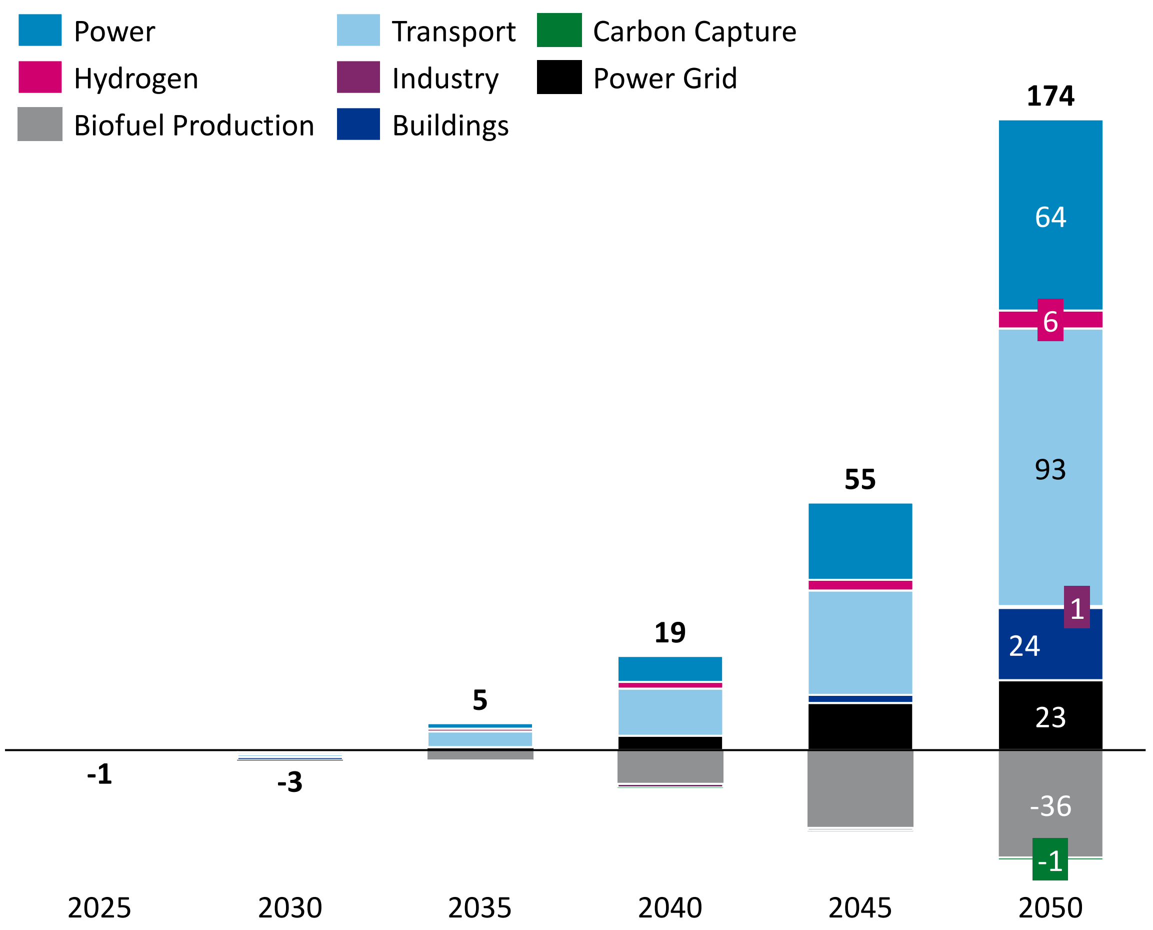


- **Not all costs are directly attributable to achieving Net Zero**; some represent system upgrade expenditures required as part of the natural evolution of the network
- These figures do not include any costs associated with operation and potential decommissioning of gas networks. With higher biomethane, greater value can be derived from use of existing gas infrastructure. Decommissioning would represent an incremental cost that could deliver additional savings in scenarios with higher biomethane deployment

Source: Energy System Catapult's ESME model, Baringa analysis

The £174bn cumulative saving in the Central Case is mostly achieved in transport, as well as power generation, avoided electricity network investments, and buildings

Cumulative System Cost Savings in our Central Case (£bn)



Key sectors	Commentary on savings from increased biomethane
Transport	Biomethane can deliver carbon removals, which allows for replacement of high-cost abatement options in hard-to-abate sectors such as aviation and HGVs,
Power	Reduced deployment of renewables, where additional build-out requires further costly system investment to manage variable risk from weather
Buildings	Preserving the use of gas boilers to deliver low levels of residual gas heating demand in the hardest-to-abate homes
Power Grid	Need for electrification gets deferred, thus reducing upfront power sector investment

Increasing the production of biomethane has benefits across the energy system. Biomethane provides cost-effective flexibility and reduces the costs of meeting peak demand. Greater biomethane avoids more costly abatement and means other technologies can be deployed at lower average-costs and with reduced supporting investments required

Source: Energy System Catapult's ESME model

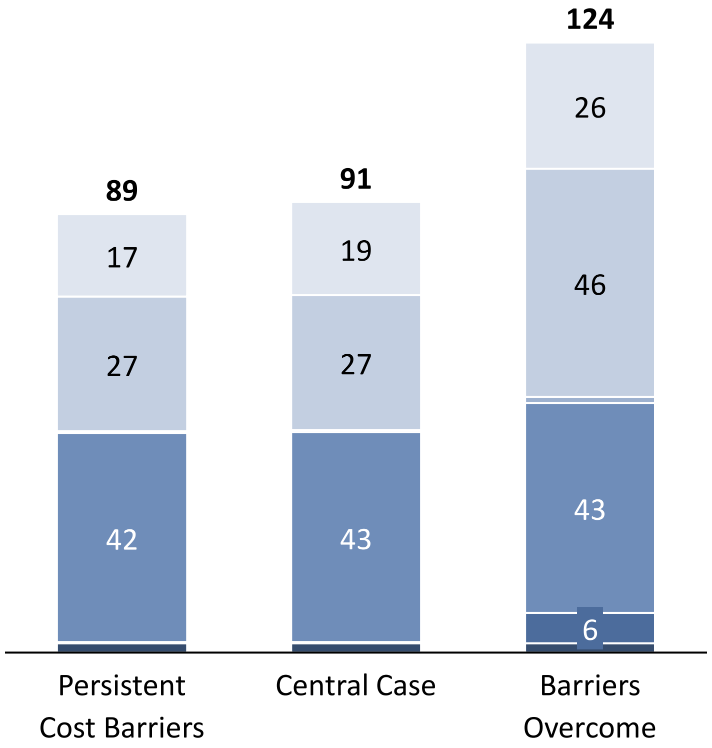
Transport

Significant cumulative cost savings from transport are driven by aviation and road transport

Savings in the Transport Sector from Increased Biomethane Production

Light road vehicles benefit from the high cumulative cost savings, particularly in the Barriers Overcome case…

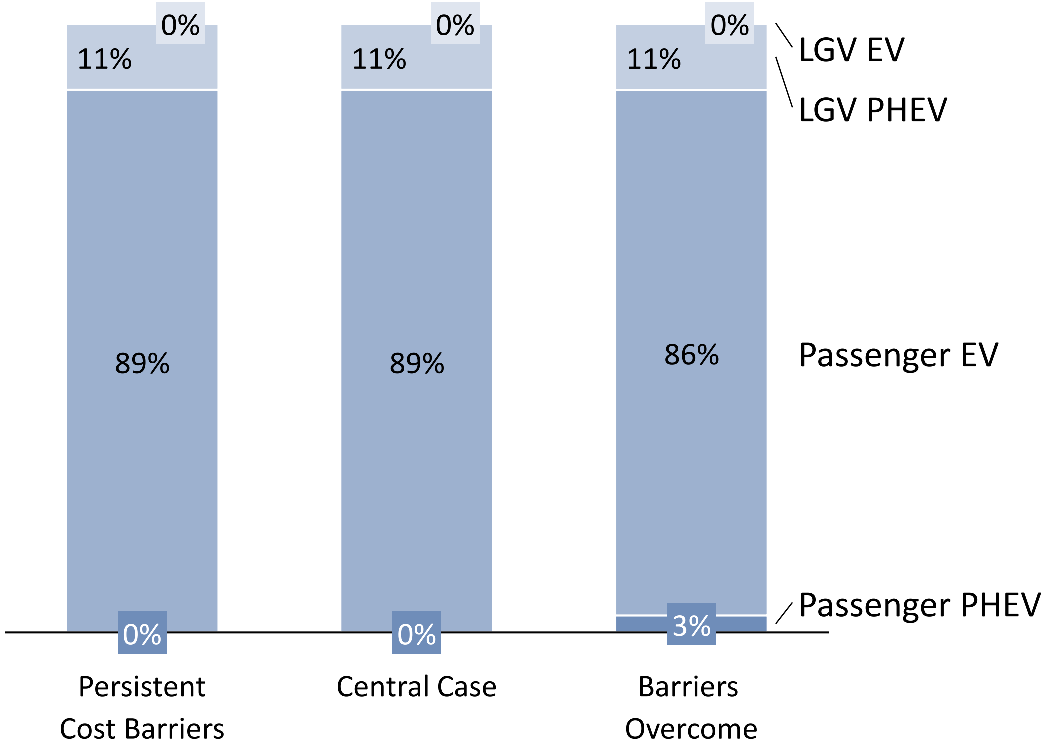
2050 Transport Cumulative Investment Cost by Vehicle Type (£bn)



	Relative Savings (2050) *Central Case*
Heavy Road	8%
Light Road	1%
Off-road	1%
Aviation	9%
Maritime	1%
Rail	4%

… which is driven by mix shifting to PHEVs[1] vs BEVs[2], allowing for costs saved in deploying network investment for EV chargepoints

Total Installed Capacity of Light Road Vehicles by Scenario, 2050 (TWh)[3]



1. Plug-in hybrid vehicles are vehicles that can run on electricity for short trips before using their engine
2. Battery Electric Vehicles are fully electric vehicles powered solely by a rechargeable battery.
3. Excludes vehicle types with <1% capacity (eg LGV ICE, Passenger ICE)

Source: Energy System Catapult's ESME model, Baringa analysis

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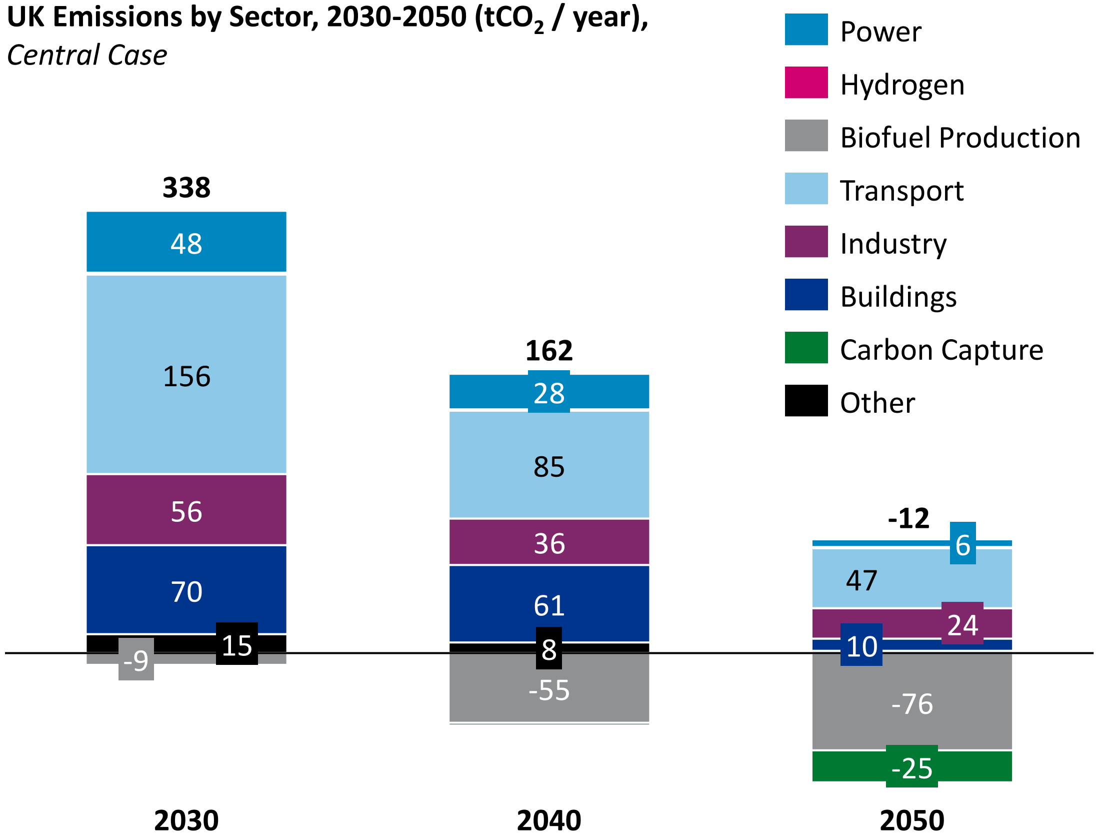
30 $MtCO_2$ of net carbon removals from biomethane avoid the need to directly abate more costly sectors like aviation

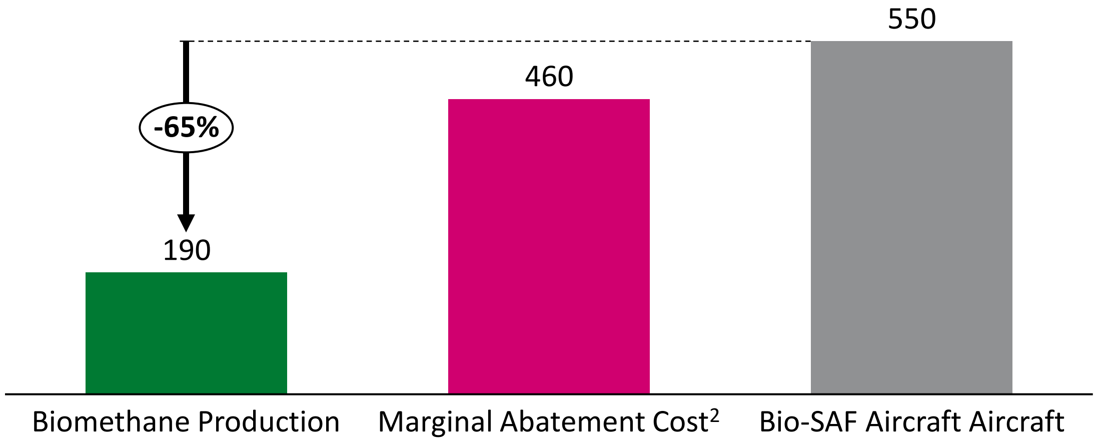
102 $MtCO_2$ of negative emissions are generated in the Central Case, with approximately 30% associated with biomethane

UK Emissions by Sector, 2030-2050 (tCO_2 / year),
Central Case



Negative emissions enable Net Zero without needing to directly abate all emissions, which may require more costly solutions

Abatement costs of Transport vs Biomethane, 2050 (£/tCO_2)[1]



1. This is a simplification for purpose of visualisation and does not represent system impacts like network build for example 2. 2050 ESME 'shadow' carbon price derived in Phase 2 energy system modelling, Central Case; this is the modelled price of carbon consistent with the Net Zero pathway and reflects the estimated cost of the marginal unit of carbon abatement required to meet Net Zero at lowest system cost

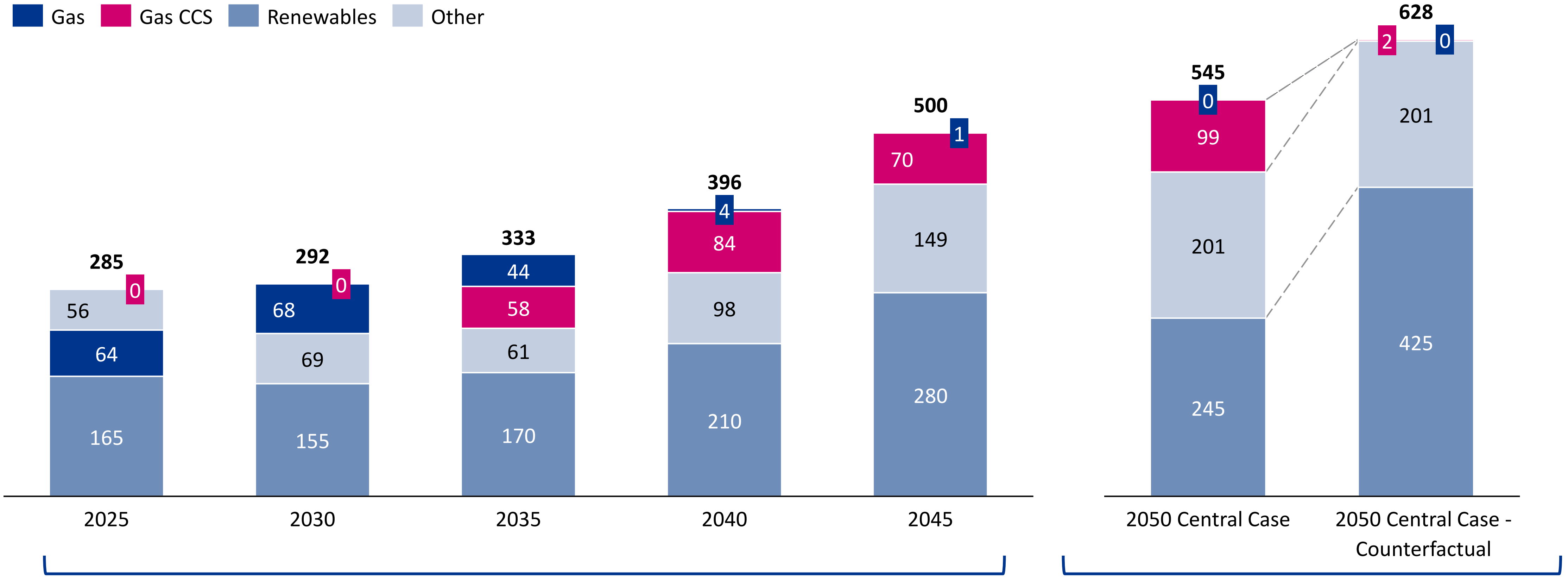
Source: Source: Energy System Catapult's ESME model, Baringa analysis

Power

Biomethane supports continued use of gas-fired power with CCS, avoiding the need to increase renewable power generation by 50% in the five years from 2045 to 2050

Power Generation by Asset Type, 2025-2050 (TWh)

Central Case – Counterfactual vs Central Case



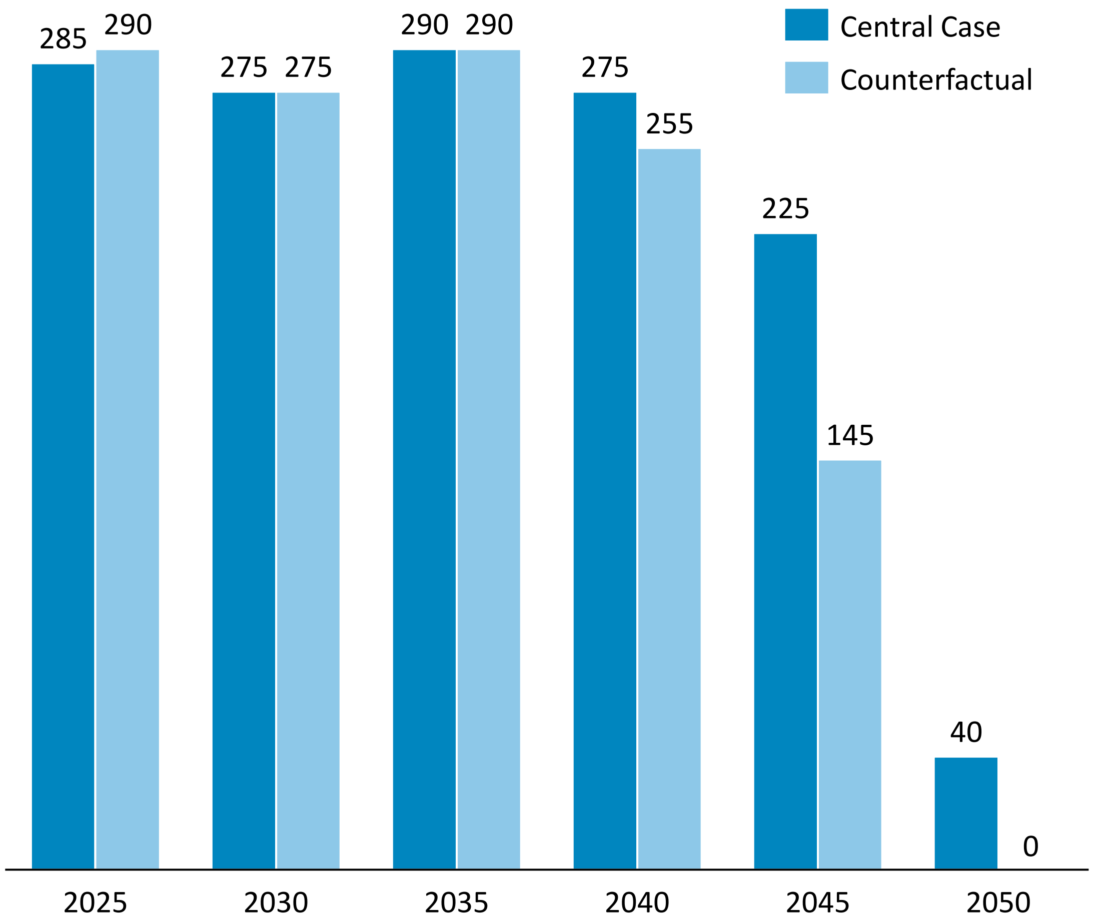
The first 20 years follow a similar trend across the Central Case and its Counterfactual (shown above)

To achieve the final emissions reductions, the Counterfactual relies on further rapid deployment of renewables, whereas the Central Case makes greater use of existing infrastructure

Source: Energy System Catapult's ESME model

Biomethane enables a lower level of heating demand to continue to be provided by gas boilers in the hardest-to-abate homes

Heating Demand Provided by Gas Boilers, Central Case (TWh thermal)



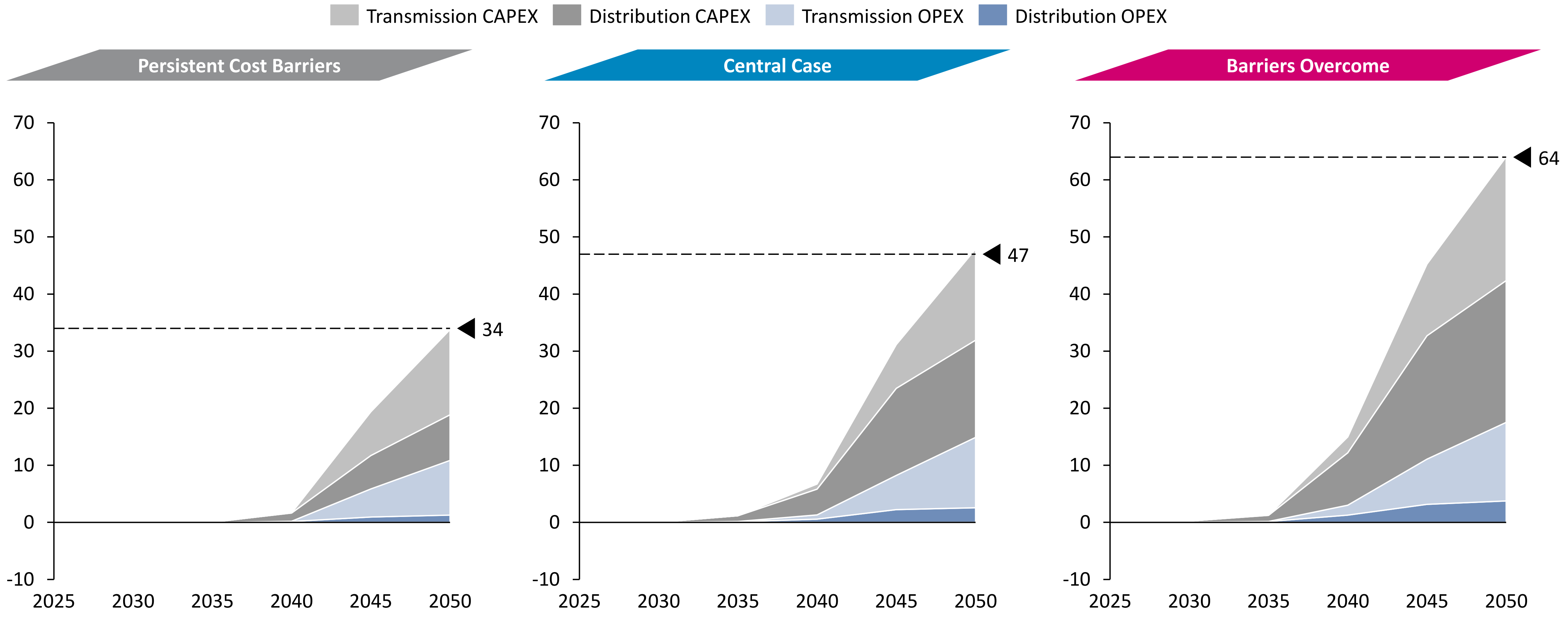
Increased biomethane availability extends the operational lifetime of gas boilers, avoiding the need to fully phase them out by 2050

- By 2050, a greater role for biomethane could ease the challenge of decarbonisation for the hardest-to-abate homes
- However, heat pumps continue to present as the most economical long-term option for home heating in most situations
- Biomethane can provide the additional benefit of safeguarding households facing financial pressure of costs associated with home upgrades (e.g. insulation, heat pumps)
- The wider implications of operating a gas distribution network with a significantly reduced level of heating demand are a key policy consideration for decarbonisation of heating

Source: Energy System Catapult's ESME model

Capex savings across transmission and distribution are the largest drivers of cumulative cost savings within the power grid – particularly in the Barriers Overcome case

Cumulative Network Investment Savings by Scenario, 2025-2050 (£bn)[1]



1. Network investment figures include savings in the "power grid" category described in the *Cumulative System Cost in 2050* results, in addition to savings included in other categories such as savings for the offshore network and charging infrastructure, captured in the "power" and "transport" categories respectively

Source: Energy System Catapult's ESME model

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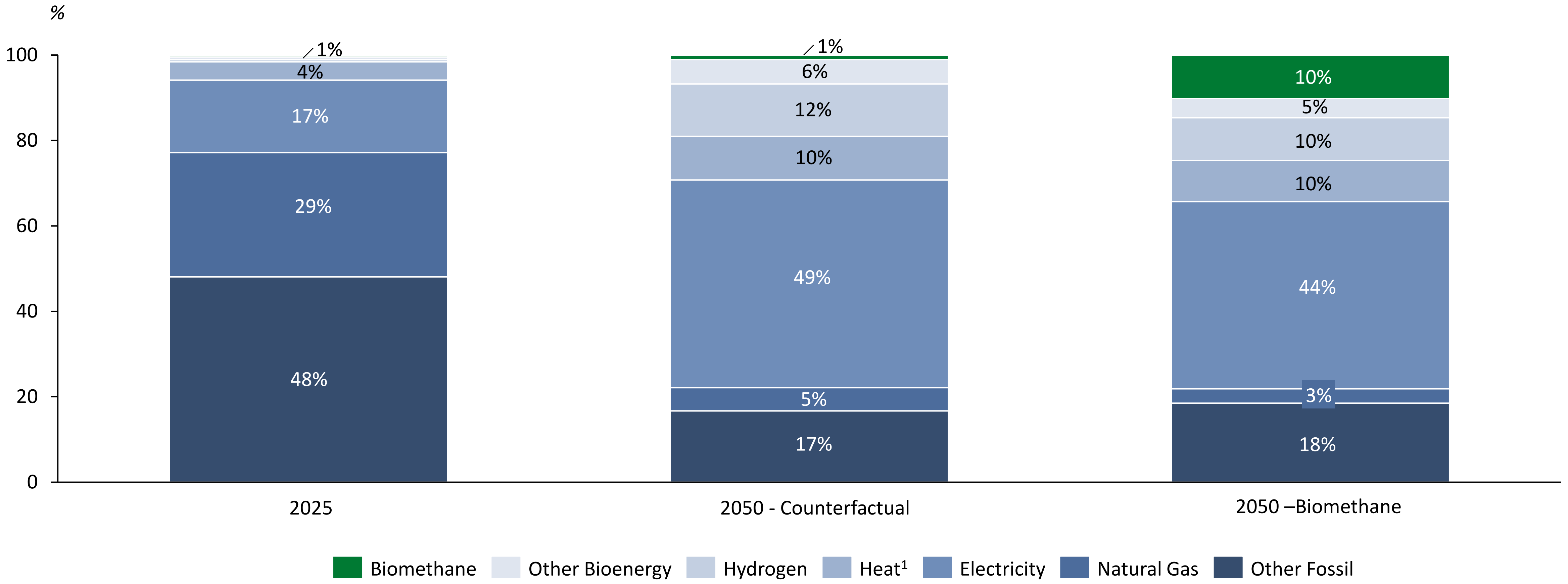
The requirement to phase out gas demand to deliver Net Zero by 2050 is reduced using biomethane

Final Energy Consumption by Energy Carrier and Scenario, 2025-2050, Central Case (% share)

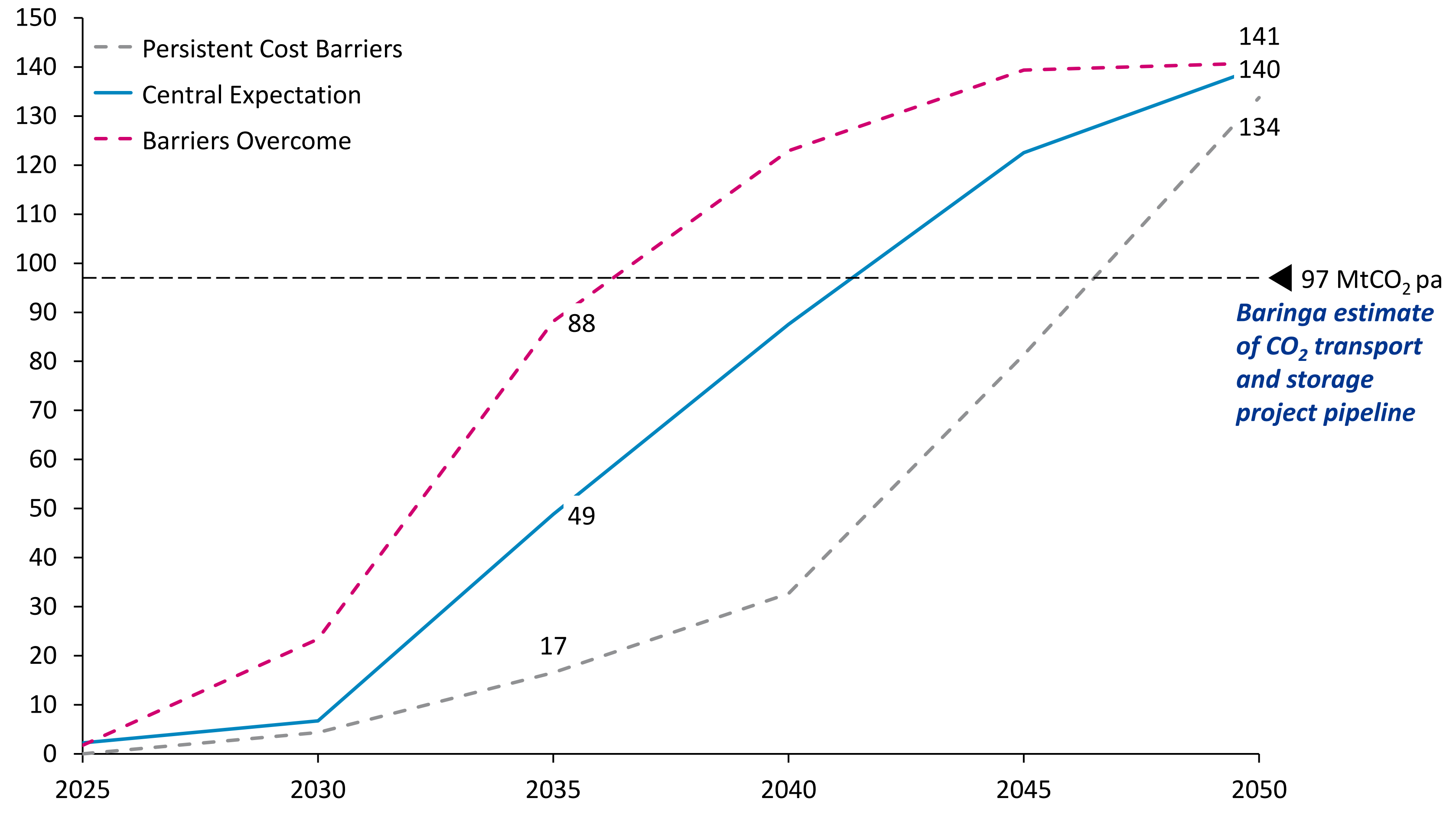
The Counterfactual without biomethane requires a higher degree of electrification and network build, which is costly at the margin. In the Central Case with biomethane, final energy consumption from gas and biomethane increases, with less coming from power



1. Heat is primarily District Heating
Source: Energy System Catapult's ESME model

The availability of CCS infrastructure is critical to unlocking biomethane's system value, both for the generation of negative emissions and sustaining the role of gas

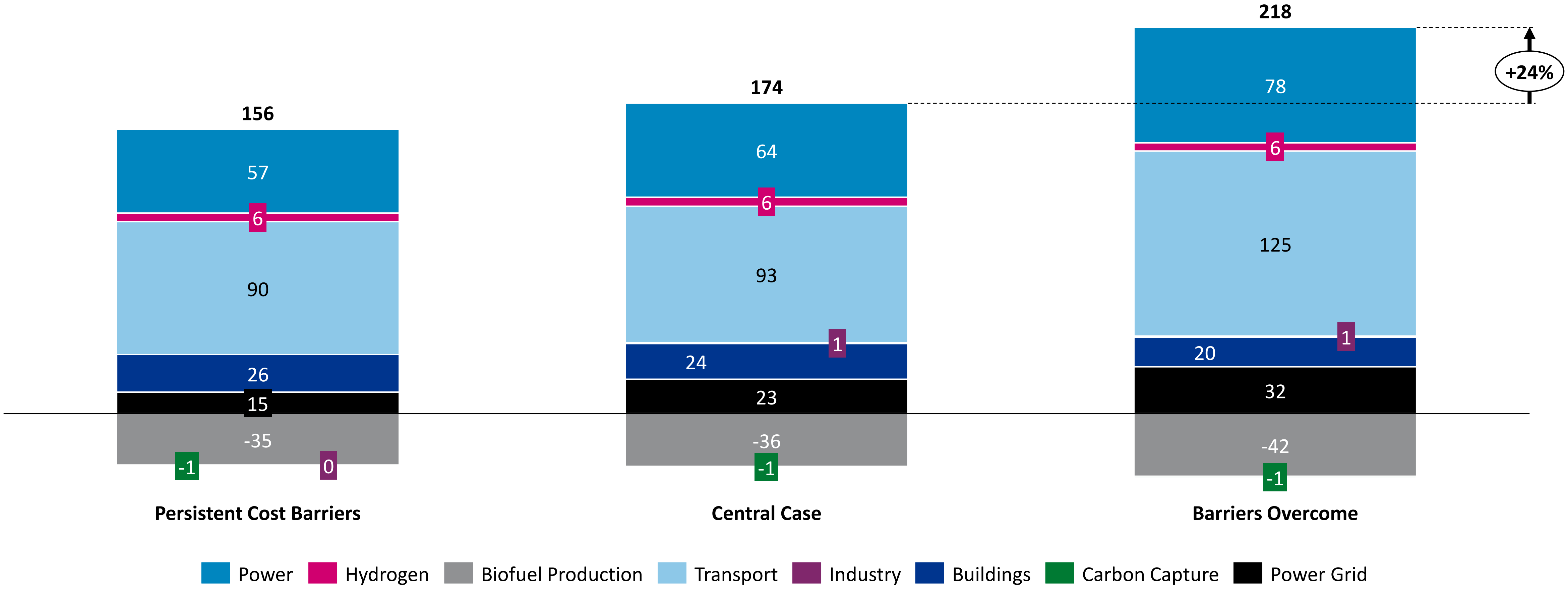
Total Carbon Captured by Scenario, 2025-2050 vs CCS Infrastructure ($MtCO_2$ / year)



- The current pipeline of CCS infrastructure (97 $MtCO_2$ pa) is **likely insufficient to support demand for carbon capture** from 2045 across all scenarios (>130 $MtCO_2$ pa)
- The UK has significant carbon storage potential, with 27 storage licenses having been awarded so far, but **CCS transport and storage infrastructure needs to be built out** , and access to stores facilitated via non-pipeline transport

The drivers of system value are consistent across all scenarios, with the Barriers Overcome scenario demonstrating increased savings from the transport sector

Cumulative System Cost Savings by Scenario in 2050 (£bn)



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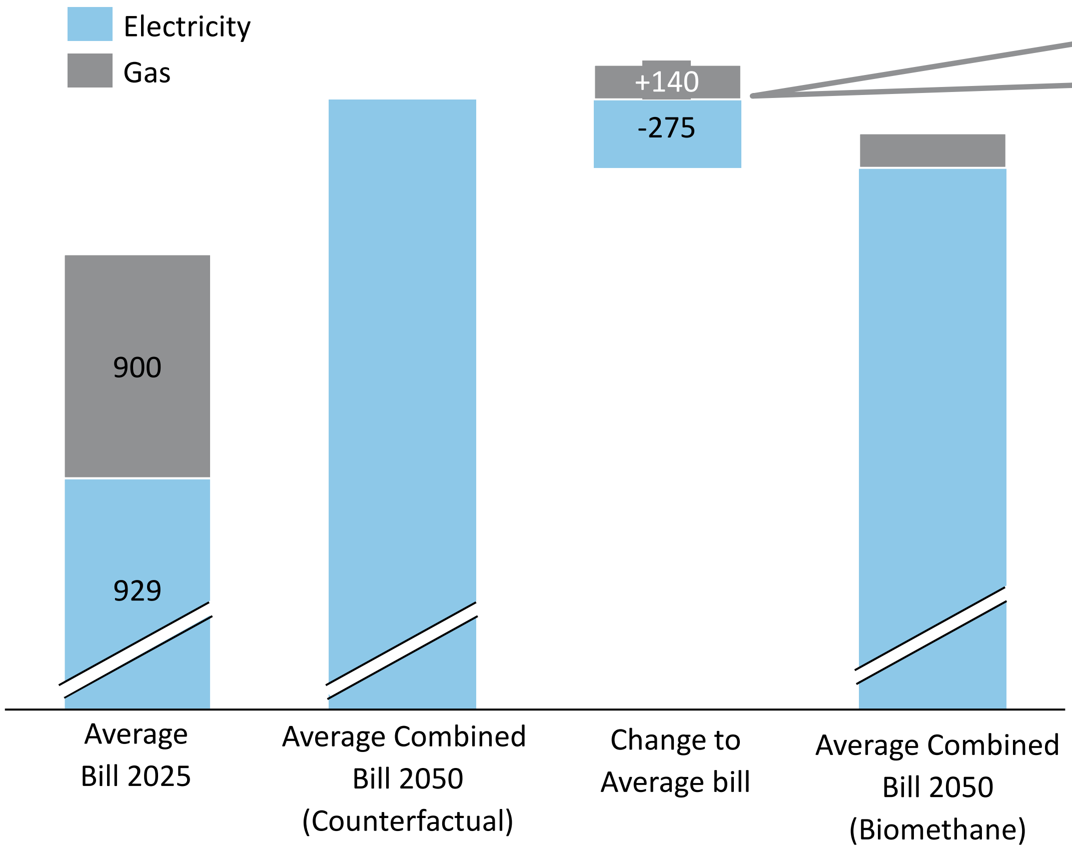
Supporting the scale up of biomethane can reduce customer bills compared to the alternative pathways to reach Net Zero

Assuming a comparable approach for system cost recovery via household bills, biomethane can support average bill savings in 2050

Summary of indicative household bill impacts in 2050, Central Case (£/annum)



- **With more biomethane in the energy system, net savings on the average household energy bill are £135/year in the Central Case**
- There are additional annualised savings of £250 per year for the average household in the cost of heating equipment and retrofit costs in the Central Case[1]

Assumptions

- We assume that power system savings are apportioned to household bills in line with the projected share of electricity demand in 2050
- The estimated gas bill impact accounts for the impact of greater wholesale fossil gas and biomethane consumption
- 2050 gas network costs are assumed to make up the same share of consumer bills as in 2025, for those households which consume gas for heating in 2050[2]
- Aligned with our Central Case results, we assume demand for gas heating is 40 TWh across the system in 2050 under the scenario with greater biomethane production. Gas demand for residential heating is assumed to be zero in the counterfactual

1. Although not a direct bill impact but relevant to consider as this represents estimated annualised savings in heat pump/insulation costs for households 2. Gas network costs per customer are uncertain and will depend on the location and concentration of users on the network. If total gas distribution network costs do not decline with the number of distribution network customers, the opportunity for bill savings will be reduced

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In this section:

- *What are the challenges of the current support scheme for biomethane?*
- *What are the near-term and longer-term policy recommendations to address these challenges?*
- *What are the implications for the cost of direct biomethane production support?*

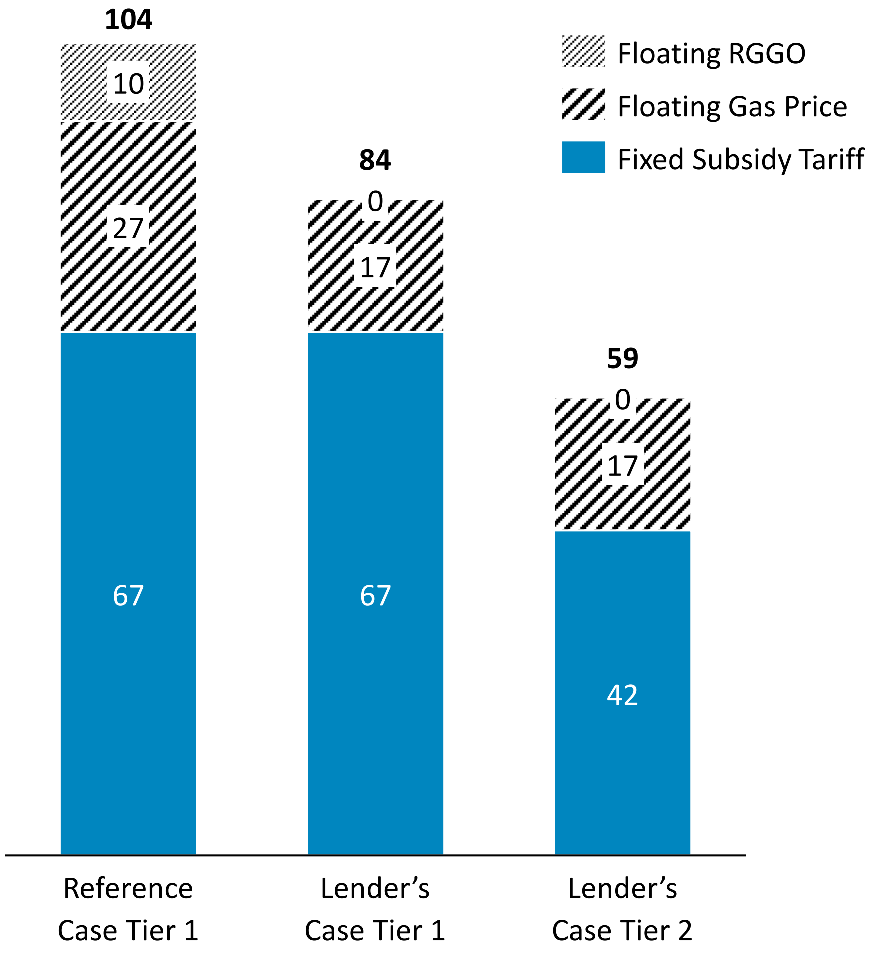
We have set out nine recommendations to enable higher volumes of production, reduce production costs and realise the wider value of biomethane

Overview of Policy Recommendations

Theme	#	Recommendation	Description
Enable higher volumes and cost reduction	1	Clarify Timeline	Clarify timelines for the Future Policy Framework and further **extend the current GGSS to avoid another hiatus**
	2	Future Support Mechanism	Design a policy mechanism which **supports cost-effective GHG savings** and helps facilitate a market for biomethane e.g., through a supplier obligation, without compromising sustainability
	3	Production Target	**Formalise a production target** of 20 TWh by 2035 to create a market for biomethane producers to fill the capacity gaps
	4	UK ETS recognition	**Recognise biomethane as zero carbon** in the UK Emissions Trading Scheme (ETS)
	5	Feedstock Evaluation	Evaluate the **sustainability of non-waste feedstocks** like rotational crops and subsequently broaden waste feedstock thresholds to recognise sustainable feedstocks with limited land use impact
Realising the wider value and supporting competitiveness	6	GGR Market	**Facilitate a market for Greenhouse Gas Removals (GGRs)** in the UK, incentivising cost-effective carbon removals from carbon captured via biomethane production and combustion
	7	Carbon Capture Access	Provide **access to CCS T&S infrastructure for all biomethane producers** who offer carbon capture
	8	Propanation Requirement	Either **reduce or remove** the need for propanation
	9	Digestate Market	**Establish a market for digestate** by creating demand support from the farming industry

The current Green Gas Support Scheme provides long-term revenue certainty to bridge government's expected production cost gap but has limited effect in reducing costs

Revenue Stack for biomethane with GGSS Tier 1 and 2 tariff (£/MWh)



The tariff provides revenue certainty at a level which government considers sufficient for a typical project to achieve a 10% return[1]

- GB's Green Gas Support Scheme (GGSS) provides a 15-year fixed tariff[2] to bridge the missing money, based on government expectations for project costs, which are regularly reviewed
- While biogas FiTs were common in the early 2010s, most EU countries have discontinued their support for biogas CHPs and now focus on biomethane for grid injection
- GGSS is funded by the Green Gas Levy (GGL), which places costs on gas suppliers
- The growing budget is currently going unspent – with 82% allocated in FY25-26, but dropping to 47% in FY29-30 (despite the absolute budget allocated increasing)
- While the tariff helps fix c. 75% of the typical revenue stack, projects raising finance take a downside view on the uncontracted portion, which may not be sufficient to achieve the return profile expected by government

Challenges of current GGSS

- Uncertainty over the future of the scheme
- Tiering of the subsidy tariffs disincentivises scale
- Treats biomethane as having equivalent emissions to fossil gas
- Limited incentive for competition among biomethane producers

1. Post-tax, nominal
2. Tariff at real 2024 values: first 60GWh priced at 6.69p/kWh, the following 40GWh at 4.16p/kWh, and the remaining to 250GWh at 3.88p/kWh

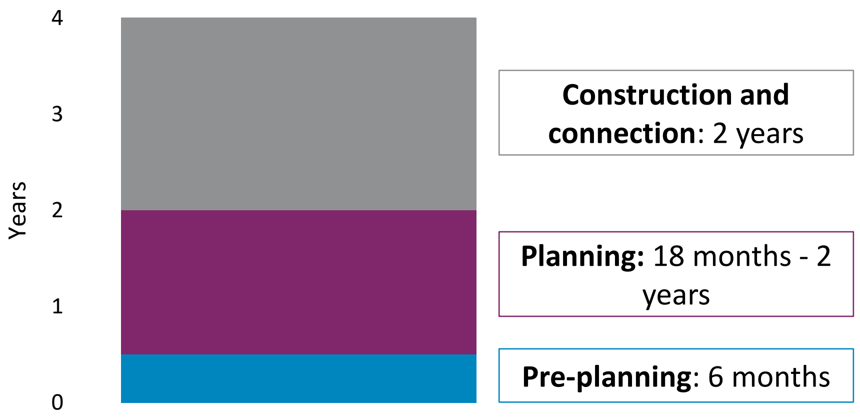
Source: GGSS Impact Assessment Final Stage IA

Investment in biomethane production is expected to dry up without clarity on future policy and an extension of the GGSS

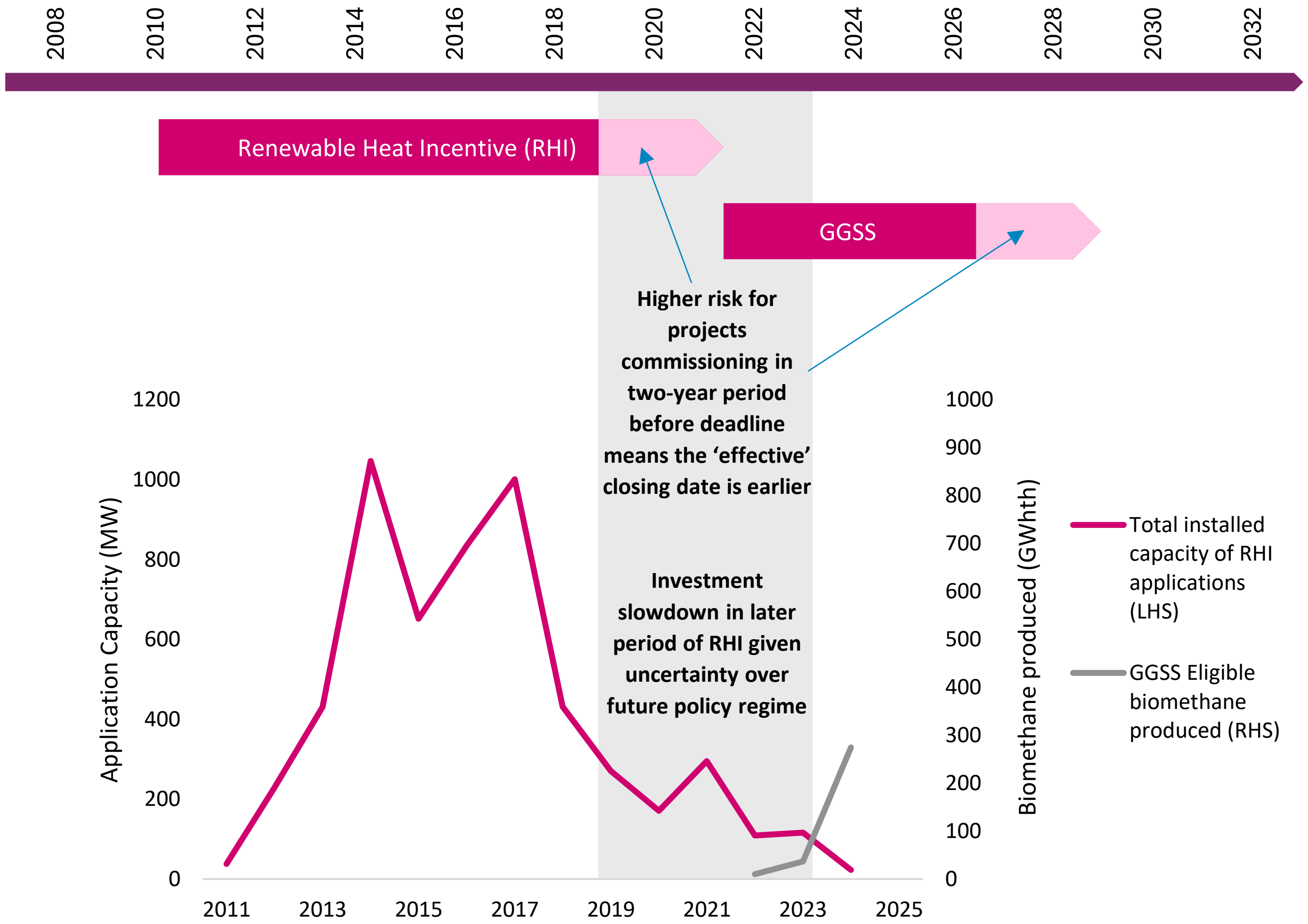
Higher risk for projects commissioning in the period before closure means the 'effective' closing date is earlier

- The GGSS was introduced as a relatively short-term measure, following closure of the Renewable Heat Incentive
- While introduction of the GGSS in November 2021 aligned with the closure of the RHI in theory, the higher risk associated with projects commissioning in the two-year period before the RHI deadline meant that the 'effective' closing date was earlier
- Given typical project construction timelines, the window for Final Investment Decisions (FID) under the GGSS is now closing, and developers are unlikely invest to progress earlier stage projects

Typical AD project development timeline



Timeline for biomethane policy support and uptake of support measures



To unlock biomethane's value, future policy should provide certainty, while supporting cost-effective GHG savings and project scale, without compromising sustainability

Principles for future policy design

Long-term certainty

Provide long-term revenue certainty to build confidence among industry and investors to grow the market.

Market-based mechanism

Establish a market-based mechanism enabling the market to determine and deploy the most economic solutions.

Compatibility and integration

Ensure compatibility and integration with relevant domestic and international policy to enable buyer confidence and avoid distortions.

Cost-effective abatement

Prioritise cost-effective carbon abatement, rather than waste feedstocks by default or constraining project scale.

1. These design principles are aligned to the Government's "Future Policy Framework for Biomethane Production: Call For Evidence" published April 2024 and their broader policies driving decarbonisation

Key design choices should reflect the four principles in future policy regime for biomethane

Key design choices aligned to future policy principles

Principle	Policy Design Question	Options	Key Considerations
Long-term certainty	On which aspect(s) of the biomethane supply chain does the policy place an incentive?	An obligation placed on the demand side e.g. consumers or suppliers Price and/or volume incentives or guarantees for producers	• Competitiveness and market power • Risk of overcompensation
Market-based mechanism	How does the policy define and facilitate the market for biomethane, and support competition?	Coordination through a regulated auction or procurement Policy funding obligations on industry, consumers or taxpayers Recognition and certification for market participants	• Balance of price stability and market exposure • Distributional impacts and cost-pass through • Administrative burden
Compatibility and integration	How does the policy ensure compatibility and integration with relevant domestic and international policy?	Review and adjustment of policy to ensure compatibility and mitigate potential distortion Adjust policy budgets/targets to reflect wider decarbonisation incentives	• Adaptability and scope for evolution • Maintaining investor confidence
Cost-effective abatement	What standards does the policy require and how is the biomethane supply chain rewarded for meeting or exceeding these standards?	Feedstock eligibility and minimum standards Multipliers or inducements to exceed or reach higher standards Reporting and monitoring requirements	• Sustainability criteria • Complexity and aligning incentives with objectives

An obligation on energy suppliers to ensure a minimum level of biomethane in the gas they supply to customers has the potential to scale production cost-effectively

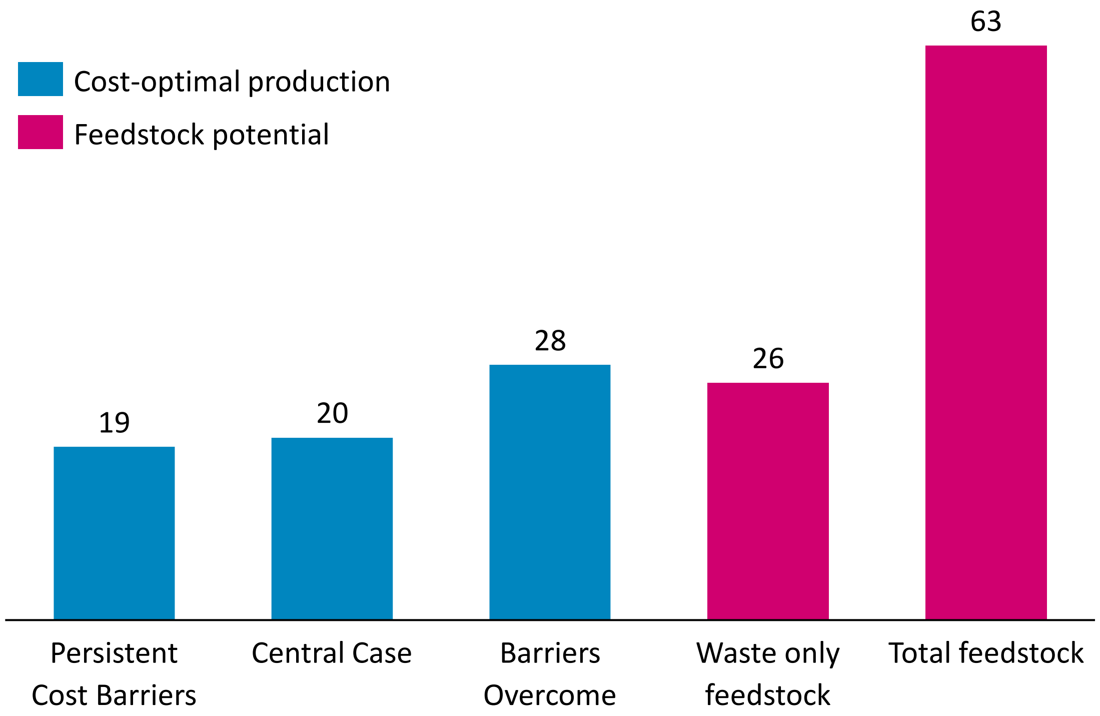
Recommended considerations for policy design principles

Principle	Recommendation	Rationale
Long-term certainty	**Support incentives should be sufficient to ensure progress towards a production target for injection into the gas grid across Great Britain**. A supplier obligation has high potential as a medium-term policy option.	Providing certainty in support incentives can de-risk investment while rewarding producers who can enable the most cost-effective path to meet targets.
Market-based mechanism	**Market development should be facilitated through an official contracting cycle.** Guidance should be developed for commercial standards and terms for agreements between suppliers and producers to ensure fairness and build investor confidence.	Facilitating the market can help to balance the risk of insufficient incentives to invest in new production against the possibility of inflated prices and limited competition.
Compatibility and integration	**Producers should be able to pursue and realise the wider value of biomethane production across markets.** Auction targets and budgets should account for any relevant sector specific mandates or industry commitments which may contribute to meeting the production target.	Sharing arrangements can mitigate risk of over-compensation, and existing production should be a price-taker for additional revenue opportunities e.g. green gas certificates or digestate. until demand exceeds availability. Revenue opportunities can then support more competitive auctions.
Cost-effective abatement	**Further incentives and penalties informed by project level net carbon emissions should incentivise the most cost-effective carbon abatement.** Incentives could take the form of price multipliers once eligible and sustainable feedstocks are defined.	Standards as to what count as sustainable, low carbon inputs avoid the risk of displacing feedstocks providing cost-effective abatement elsewhere or incentivinsg the use of undesirable feedstocks. Without multipliers, the policy could fail to cost-effectively incentivise GHG savings per unit of gas.

We consider a production target of 20 TWh by 2035 to be 'low regrets' given modelled outcomes. This aligns with production targets in comparable EU countries

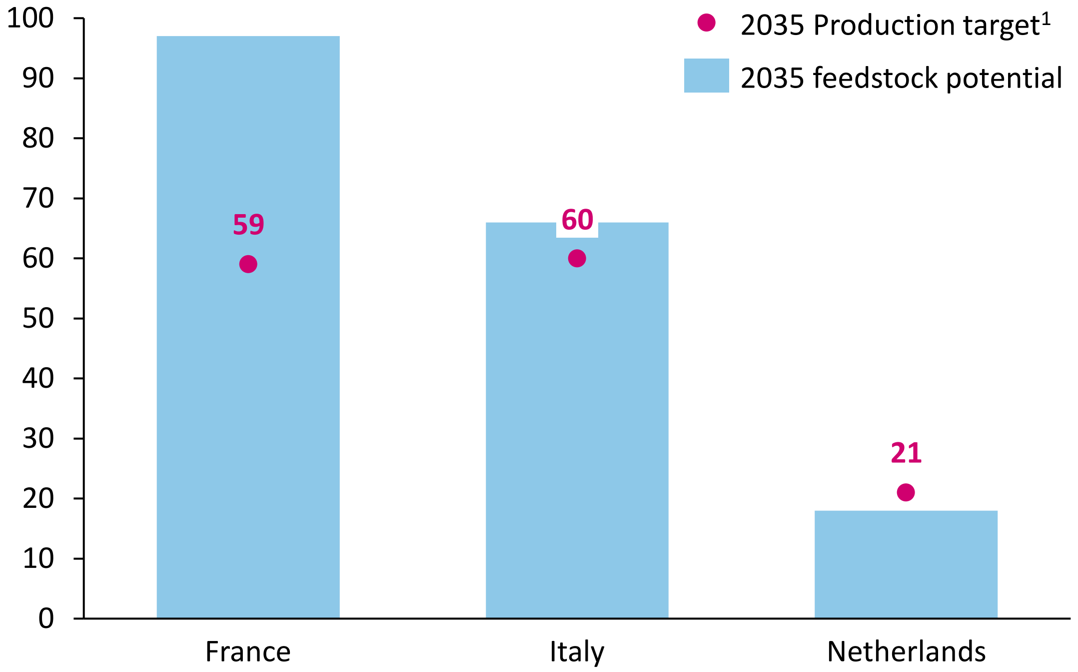
20 TWh is the lower end of cost-optimal production across our modelled scenarios and deliverable with waste feedstock

Cost-optimal deployment and feedstock potential by 2035 (TWh)



Comparable countries have set similar targets, with France and Italy having much higher ambitions, at c. 60 TWh

Production targets and feedstock potential by 2035 in comparable EU countries



1. Production targets are 2030 for Italy and the Netherlands, and 2035 for France

Sources: ESME Modelling; Alder Bioinsights Feedstock Study 2025; EBA Gas for Climate study, 2022

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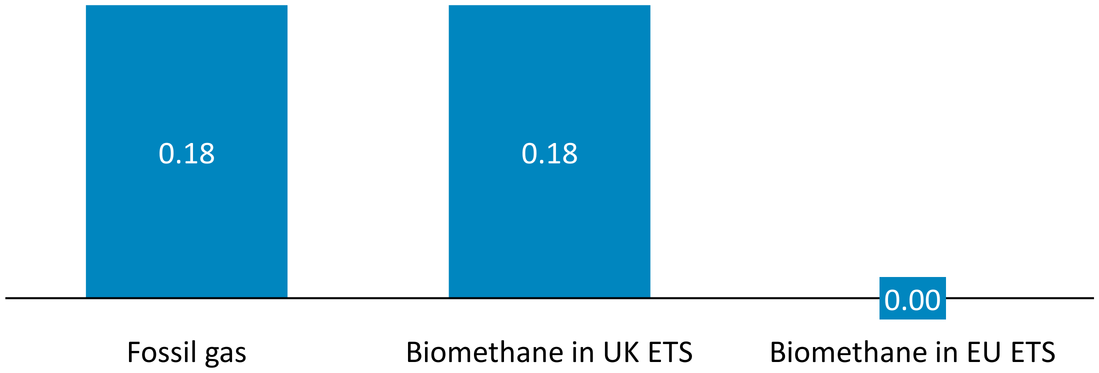
Recognition of biomethane as a zero-carbon fuel in the UK ETS would help bridge the production cost gap and better align with European policy

Biomethane is currently treated equivalently to fossil gas in the UK ETS, which is at odds with European precedent

Treatment of fossil gas and biomethane combustion emissions by region



- Biomethane delivered via the grid to a consumer is currently treated as having the same GHG emissions as fossil gas in the UK ETS, meaning there is no fundamental willingness to pay from consumers to purchase biomethane
- By contrast, many European countries permit the use of biomethane as a solution to reduce ETS obligations, including Germany, Denmark, Republic of Ireland, Belgium, and the Netherlands
- While ETS recognition alone would not be sufficient to bridge the production cost gap in the short term, it would provide an important revenue stream to producers and help establish buyer confidence among consumers

Expanding UK ETS sector coverage would willingness to pay across key sectors for gas and biomethane

Summary of current gas demand by sector and UK ETS coverage

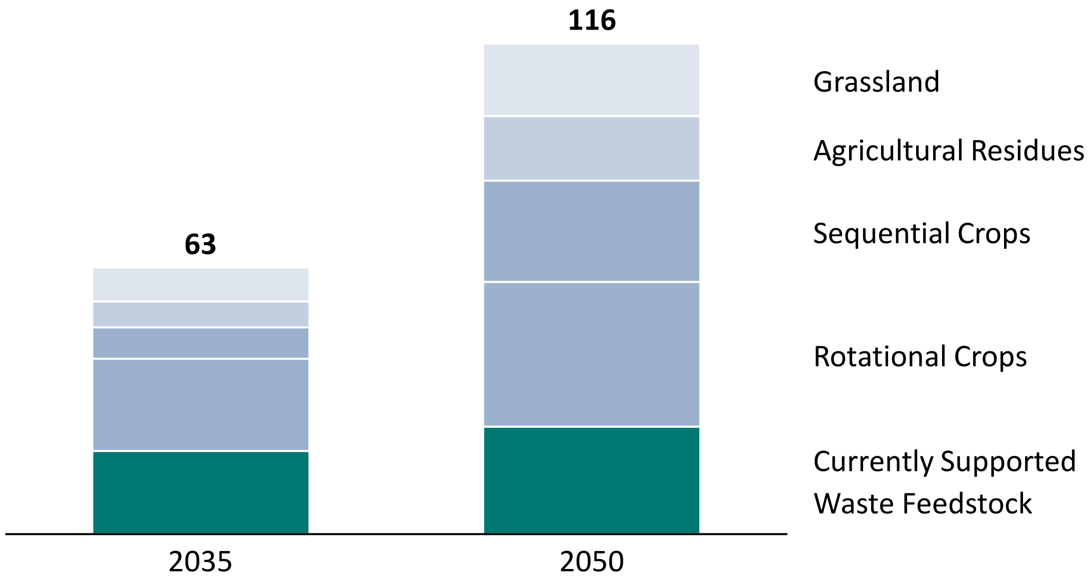
Sector	Share of Gas Demand	UK ETS coverage
Power	20-25%	✓
Industrial	20-25%	✓
Residential	35-40%	✗
Commercial	10-15%	✗
Transport	<1%	✗

- The UK ETS currently applies to c. 25% of UK territorial emissions, including heavy industry, power generation and aviation, meaning only c. 40% of gas demand is exposed to carbon prices through the scheme
- An expansion of the sectors covered by UK ETS could help mitigate distortions between consumer groups and ensure the carbon cost of fossil gas is appropriately reflected
- In Europe, the scope of emissions covered by an Emissions Trading System is being expanded with the implementation of a new scheme (ETS 2) which will run in parallel to the current ETS and cover sectors like road transport and buildings

Broadening the scope of sustainable feedstocks beyond wastes can enable higher production volumes and cost reductions

A large and growing share of biomethane potential in the UK is from feedstocks which are not currently supported by the GGSS

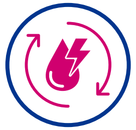
Feedstock potential (TWh) and treatment in UK GGSS



- The GGSS requires at least 50% of biomethane energy production must come from waste feedstocks, defined as "any substance or object that the holder discards or intends or is required to discard"
- This does not include intermediate crops, such as catch and cover crops, which represent more than half of the UK biomethane feedstock potential by 2050 based on independent studies[2]

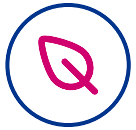
The UK should re-define its feedstock framework with a robust Life Cycle Assessment (LCA), learning from European examples

Sustainable and 'advanced' feedstocks in Europe[1] (non-exhaustive)



✓ Sewage sludge and biomass fractions and residues of waste from forestry

✓ Biomass fraction of mixed municipal waste



✓ **Intermediate crops** which do not trigger demand for additional land or **crops grown on severely degraded land** other than food and feed crops

- The binary treatment of "waste" and "non-waste" feedstocks in the UK GGSS fails to recognise the environmental benefits that can be attained from the growth and utilisation of intermediate crops, as well as the opportunity to increase feedstock potential by using land which would otherwise not be used e.g. for food production
- These intermediate crops are explicitly recognised as being 'advanced' in European legislation

1. As per RED II Annex IX Part A, 2. Alder Bioinsights

Recognising the wider value of biomethane to the system can lead to greater competitiveness of biomethane production

Government must ensure a framework is in place to enabler carbon removals and that infrastructure is prepared for biogenic CO_2 storage

Stimulate GGR Demand

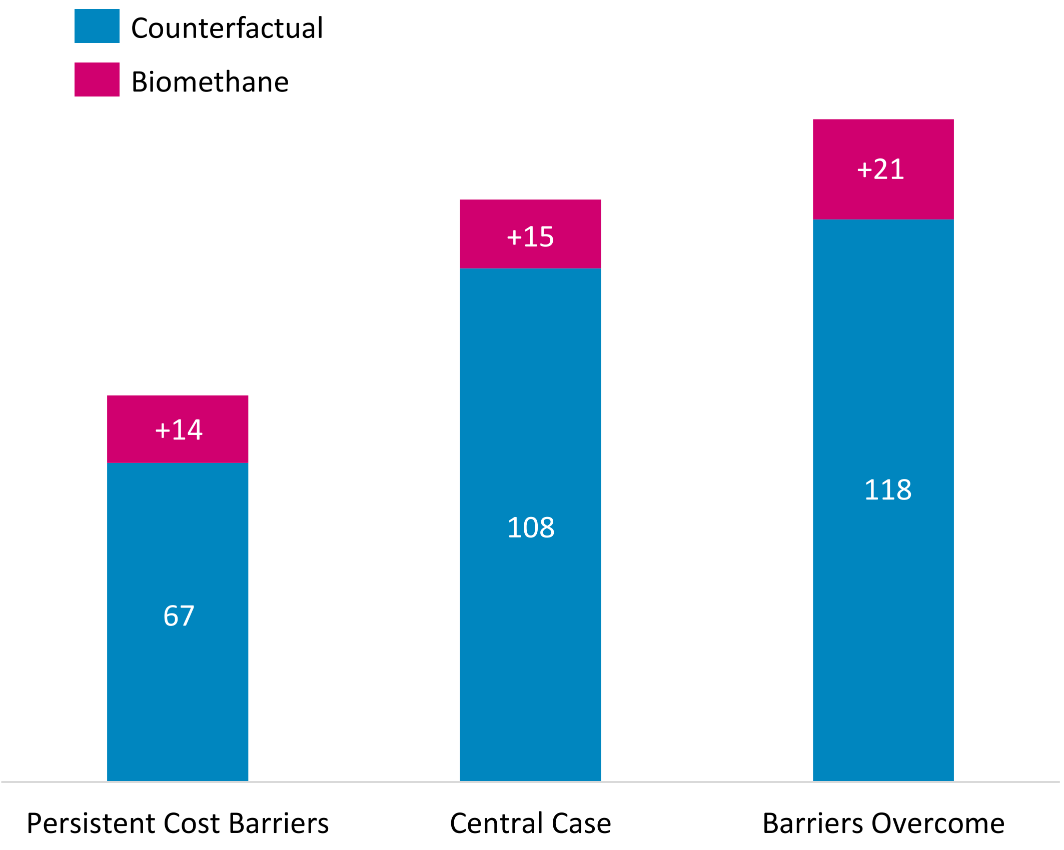
- Recognition of grid injected biomethane in UK ETS recognises biomethane abatement potential in the near term
- Longer term, facilitating, and stimulating a market for GGRs is needed
- This allows supply and demand for carbon removals to be matched, with removals certified and netted off for emitters
- The GGR framework should also recognise captured CO_2 from combustion of network gas as carbon removal when presented alongside a green gas certificate

Develop CCS Infrastructure

- Captured biogenic CO_2 from biomethane production presents a high potential use case for the developing CCS transport and storage network
- Sizing and ambition for CCS infrastructure development should recognise the potential for biomethane with CCS, to support lowest cost decarbonistion
- Infrastructure development should ensure access to stores facilitated via non-pipeline transport

With greater biomethane the requirements for CCS infrastructure increase from 2045 across all scenarios

Total Carbon Captured by Scenario, 2045 ($MtCO_2$ / year)



Source: Baringa LCOE Model, Baringa analysis

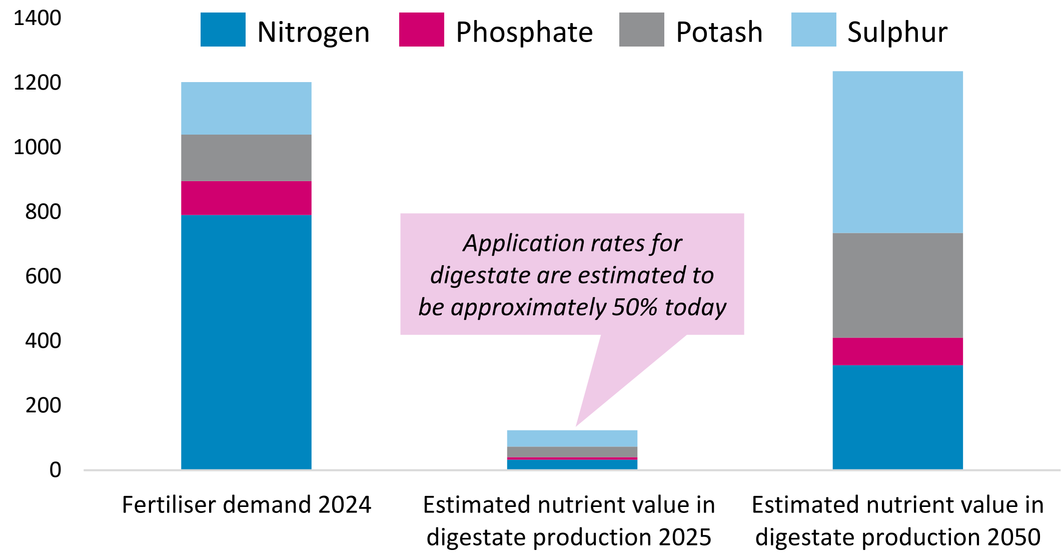
Creation of markets for digestate and removal of propanation requirements can reduce the need for reliance on subsidy

UK biomethane production is more cost-effective if propanation can be phased out, learning from where this has been achieved

Country	Requirements	Operational Implications
	Biomethane must match the calorific value of the local grid Propane blending is not a default requirement, but may be used to meet energy equivalence when necessary	In practice, most biomethane plants do not add propane, as modern purification technologies, supported with real-time data measurement can achieve the required methane concentration without it
	Regulations allow flexibility in technical configuration. Biomethane quality must be compatible with the gas grid with quality controls in place	Italian injection stations use gas chromatographs to monitor biomethane composition. If the methane concentration is below grid requirements, propane may be added
	Biomethane must match the combustion properties of natural gas in the Danish grid	Danish biomethane producers focus on methane purification and CO_2 removal, with propane used only if needed to meet specific grid energy values

Increased production and uptake of digestate can support carbon abatement and greater resource efficiency in fertiliser use[1]

Fertiliser demand and digestate nutrient value (thousands of tonnes)



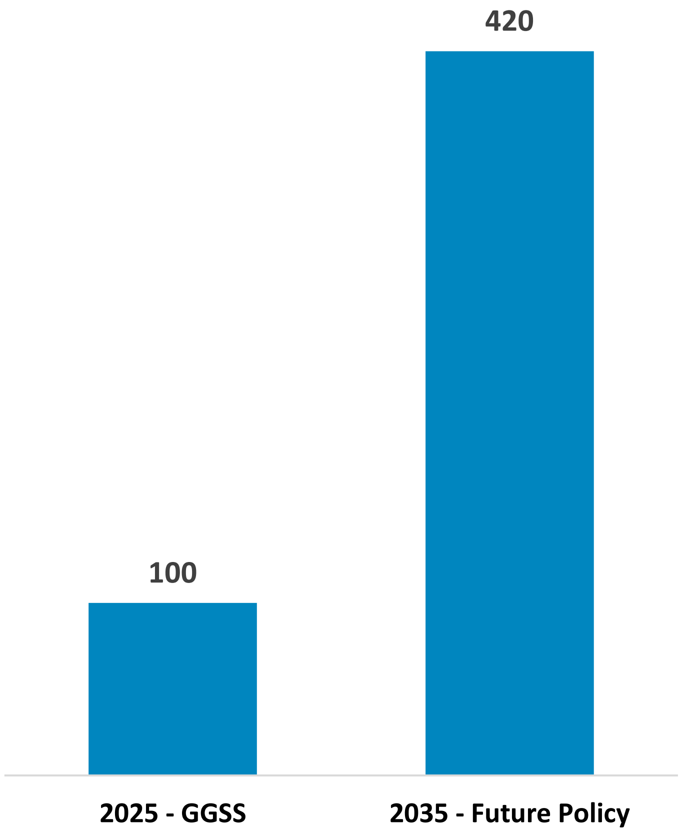
- While not a like for like replacement, **greater use of digestate can reduce reliance on artificial fertilisers which are currently emissions intensive**
- While the applicability of digestate will depend on the nutrient requirements, incentivising emissions reductions in fertiliser use can support greater uptake of digestate and more efficient application of fertilisers
- A *low carbon fertiliser standard* can also set out criteria for fertilisers that have a reduced carbon footprint compared to conventional products, through processes like waste valorisation, green hydrogen use, or nutrient use efficiency

Notes: 1. We assume that biomethane production scales to 115 TWh by 2050, in line with modelling scenarios for higher biomethane potential
Sources: The British Survey of Fertiliser Practice 2024, The Official Information Portal on Anaerobic Digestion

By 2035 future biomethane policy support can be up to 60% more cost-effective than the current GGSS per unit of biomethane production supported[1]

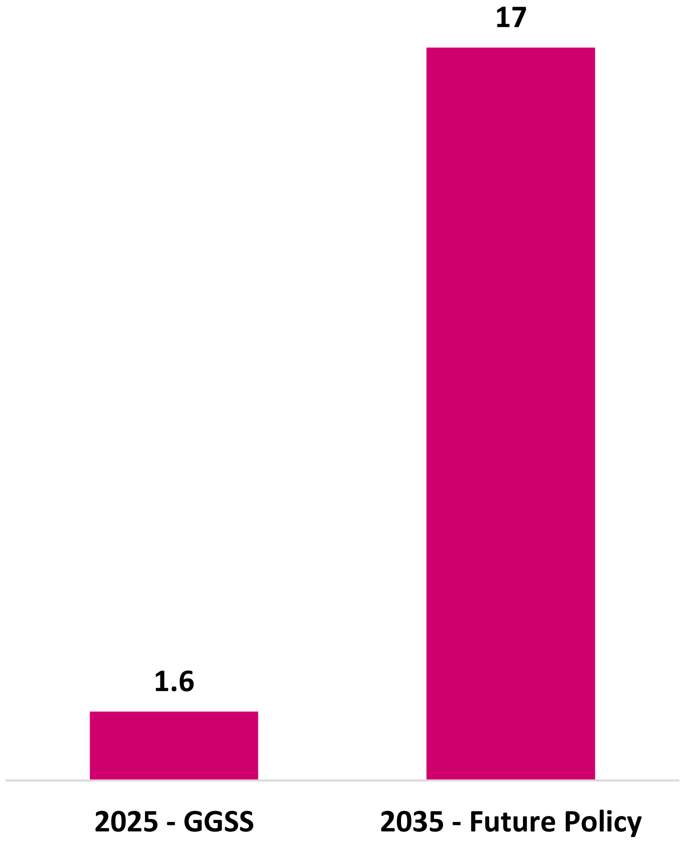
In the near term, continued policy support is expected to be required to scale production

Estimated biomethane support costs under current and future policy (£m/year)



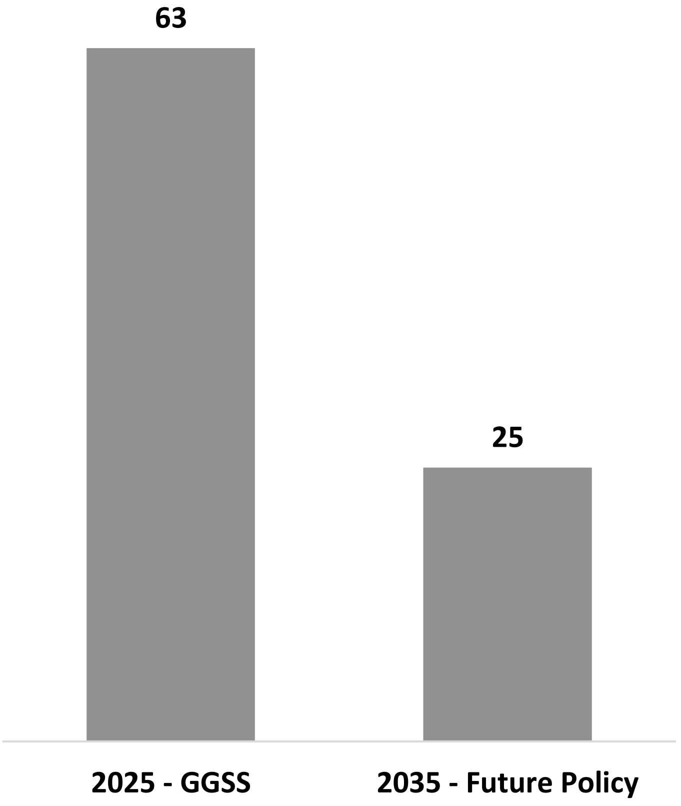
Policy needs to scale production capacity at a rate of 1.5-2/TWh per year to meet the target

Biomethane production supported under current and future policy (TWh/year)



With improvements in economics, required support per unit of production could fall

Estimated support costs per unit of biomethane under current and future policy (£/MWh)



1. 17 TWh additional production supported by the new policy scheme in 2035 is aligned with the modelled optimal production increase from 2025 to 2035 in the Central Case scenario

Source: Baringa analysis

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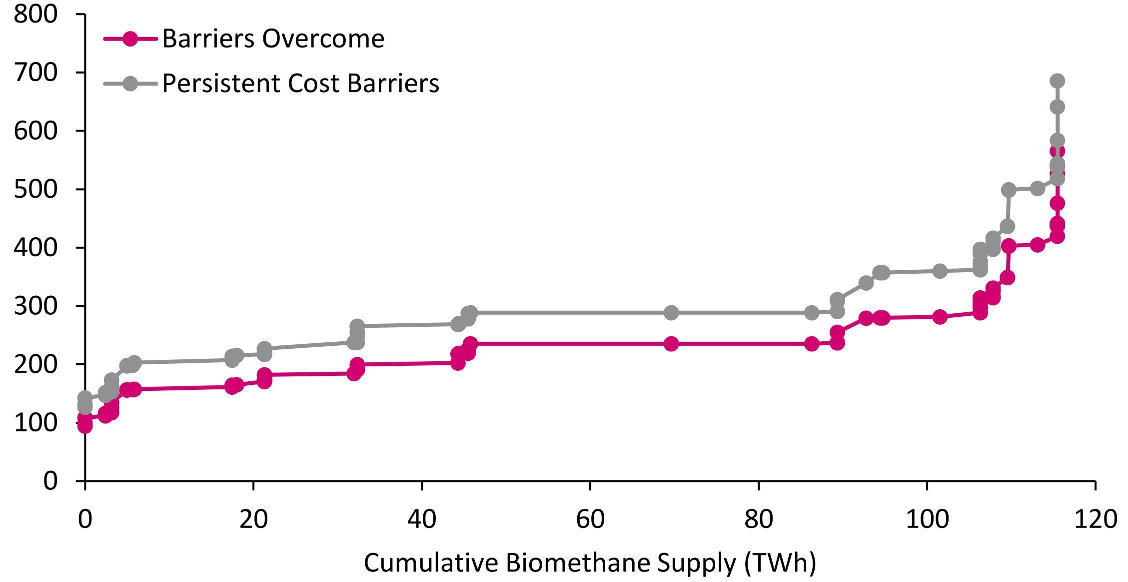
By 2050, if value delivered from enabling GGRs can be realised, direct support for biomethane production can be phased out

With Barriers Overcome, abatement costs could fall to less than £200/tCO_2 for 45 TWh and less than £290/ tCO_2 for 100 TWh

Biomethane Abatement Cost Curve 2050 (£/tCO_2)



Growing project scale and CCS uptake means biomethane can be produced without direct subsidy at GGR prices of £150/ tCO_2 or more

Summary of impacts of ETS and GGR prices on biomethane production that can be delivered without direct subsidy, 2050 Barriers Overcome scenario (TWh/year)[1]

UK ETS Price (Low → High) \ GGR price (Low → High)	£ 150	£ 200	£ 250	£ 300
£150 (High)	30	90	106	110
£125	21	45	106	110
£100	18	32	94	106
£75 (Low)	17	21	45	106

- **GHG abatement cost example:** a biomethane project with a net production cost of 100 £/MWh and fossil gas equivalent revenues of 30 £/MWh would have missing money of 70 £/MWh. If the biomethane produced saves 0.183 tCO_2/MWh[1], the project would have a GHG abatement cost of c. 380 £/ tCO_2 (=70/0.183)
- **Abatement costs increase with biomethane production** because the most cost-effective feedstocks and projects are developed first. As output grows, producers move to more expensive or less effective options

1. Production without direct subsidy represents estimated volumes delivered at or below the projected price for fossil gas, assuming marginal unit of gas production faces UK ETS costs

Source: Baringa LCOE Model, Baringa analysis

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Glossary

Term	Definition
AD	Anaerobic Digestion – process where microorganisms break down organic matter without oxygen to produce biogas and digestate
BEVs	Battery Electric Vehicles – vehicles powered entirely by electricity stored in batteries
CCS	Carbon Capture and Storage – technology that captures CO_2 emissions and stores them permanently underground
ETS	Emissions Trading System – a market-based system where companies trade permits to emit greenhouse gases
GGL	Green Gas Levy – UK levy on suppliers to fund renewable gas schemes
GGSS	Green Gas Support Scheme – UK government scheme supporting biomethane injection into the gas grid
GHG	Greenhouse Gas – gases such as CO_2, CH_4, N_2O that trap heat in the atmosphere
GGRs	Greenhouse Gas Removals – processes or technologies that remove greenhouse gases from the atmosphere (negative emissions)
LCOE	Levelised Cost of Energy – average cost per unit of electricity generated over a project's lifetime
LHV	Lower Heating Value – measure of the energy content of a fuel excluding the latent heat of vaporisation of water
PHEVs	Plug-in Hybrid Electric Vehicles – vehicles with both a battery (rechargeable by plugging in) and an internal combustion engine
RGGO	Renewable Gas Guarantees of Origin – UK certification scheme proving the renewable origin of gas injected into the grid

Some of the contents of this document were produced using the Energy System Modelling Environment ("ESME") and data of the Energy System Catapult.

Reducing the cost of Net Zero with biomethane

The Green Gas Taskforce is a collaboration between thirteen of GB's largest biomethane generators, shippers and traders, all five British gas networks, and four important industry organisations. The Taskforce will be producing a series of key reports and analysis, outlining the scope for growth of biomethane in Great Britain and the significant contribution it can deliver to the decarbonisation and energy security of the country.

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