THE ROLE OF GREEN GAS IN NET ZERO

CUTTING THE COST OF KEEPING THE LIGHTS ON

BMA

A report from ADBA and BMA

ADBA

The Role of Green Gas in Net Zero

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CREDITS

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FOREWORD: WELCOME THE "BIG GREEN BATTERY"

For several years there has been a mystery about UK policy towards climate change and net zero emissions: the lack of serious interest in green gas - biogas and biomethane. Green gas is made from any rotting organic matter – domestic and commercial food waste, sewage, manures and slurries, industrial wastes (such as brewing and whisky residues), farm wastes, green wastes, break/cover crops and dedicated energy crops. If left to rot, these wastes emit methane, a powerful greenhouse gas that should be captured and used instead of fossil gas. Purified biogas – biomethane – is a substitute for fossil gas because it is molecularly identical.

The Russian invasion of Ukraine, and soaring gas prices, changed everything – except in Britain. In the European Union, the EU Commission made biogas one of the three pillars of its response to the crisis, since green gas is home-grown and replaces fossil natural gas. The sector has been booming in Italy, Spain, France – almost everywhere except Germany which already had a big sector with more than 9,500 biogas plants.

In the United States, the sector has also grown rapidly and has benefited from the Inflation Reduction Act. The International Energy Agency (IEA) projects global biogas growth between 8 and 26 percent a year to 2035 depending on the strength of public policy. By contrast, the UK sector is if anything set to slow down, as last year's respectable 14 per cent growth reflected investment decisions taken during the Russian gas crisis. The UK has bumbled along with modest support schemes for transport use and injecting biomethane into the gas grid.

Why? The fundamental problem has been an underestimate by UK policy-makers of how much organic material could be used to generate biogas, and of therefore how big the sector could become. The latest government biomass strategy – which included biogas – said that we could generate 35 terawatt hours of energy from our feedstocks. British policy-makers see the sector as nice to have, but small in the big picture of things. In fact, recent studies put the total that could be produced by green gas at anywhere between five times and 16 times higher than the Government's target.

This chronic underestimate of the potential of the sector has led to policy neglect: there are three times as many civil servants working on hydrogen as biogas (even though it has yet to produce any gas in commercial quantities), and several times more working on nuclear. In an oversight, the sector is penalised by the Emissions Trading Scheme as it treats biogas as if it were fossil natural gas. Crucially, Whitehall has even failed to ask its modellers to forecast green gas separately from fossil gas, so that the Department of Energy Security and Net Zero (DESNZ) would struggle to answer any questions about the benefits of biogas and biomethane to the whole energy system.

We have set out to rectify that omission with this study. ADBA commissioned Business Modelling Applications (BMA) to incorporate biogas and biomethane into its Decisio™ AI-assisted planning system – a computer model of the whole energy system currently being used by both DESNZ and NESO. We wanted to assess the impact on the National Energy System Operator's (NESO) recently released 2024 Pathways to Net Zero (PNZ, an update on its 2023 Future Energy Scenarios). Along with other data on the sector, ADBA provided its cautious assumptions about the availability of feedstock, which are middle of the road between DESNZ's unjustifiable pessimism and the enthusiastically high estimates in the recent study from Ecotricity, as the basis of the analysis done by the Decisio™ system. The results will surprise Whitehall. Expanding the use of biogas and biomethane would be a cheaper way of achieving net zero than the official scenario, saving £415 a year per British household and £298 billion overall.

In our projection, the electrification of the economy stays in place, including the electrification of home heating through heat pumps. But what keeps the lights and heaters on in dark winters when power demand surges, solar yield is zero and wind is unreliable? The capital costs of nuclear power stations are so high that, once built, they can only be justified for baseload power, and not as temporary or intermittent back-up generation. The role of batteries is similarly limited as they are neither cheap nor scalable enough to store excess renewable power generated in sunny July for use in dark January. Low carbon gases offer uniquely low-cost energy storage at scale using existing infrastructure.

The answer to the challenge of intermittent and seasonal renewable generation is cheap gas turbines fuelled either directly by biomethane, or indirectly through hydrogen produced from biomethane. Green gas is the cheapest back-up for the power system. More green gas means that we will need less offshore wind (as enormous over-capacity will not be necessary) and fewer new transmission lines as green gas production and transport through the existing gas networks allows for local electricity generation. There are other savings too: for example, on the number of nuclear power stations, and the need for expensive and inefficient hydrogen production through electrolysis.

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Denmark has long been a net zero thought leader. The Danes identified the importance of biogas and biomethane early. For example, Denmark is home to Nature Energy, Europe's largest green gas company recently bought by oil and gas major Shell. The Danes call green gas the "Big Green Battery" because it produces energy all year round that can be easily stored and transported for use when needed during winter demand peaks or windless lulls. As another northern country with a dark winter, Britain should wake up to the opportunity that green gas offers for our net zero future.

Finally, I would like to thank the team at Business Modelling Applications (BMA) for their hard work in incorporating detailed green gas analysis into their Decisio™ whole energy system planning platform. ADBA's rich industry database provided the data to do so, and the ADBA team, ably led by Dr Gareth Mottram, provided guidance on the assumptions and scenario definitions based on the scale and distribution of available feedstocks. Our joint efforts now allow us to set out what is at stake.
Chris Huhne, Chairman, ADBA

EXECUTIVE SUMMARY

- **More green gas used in the transition to net zero will save £298 billion in the cost of the energy system, equivalent to £415 a year for every British household.**
- **More green gas can be added quickly so it also reduces the cost of meeting the Government's goal of clean power by 2030, saving £22 billion equivalent to £133 per household each year.**
- **These conclusions are based on Business Modelling Applications' (BMA) Decisio™ whole energy system modelling platform, currently used by the Department of Energy Security and Net Zero (DESNZ) and National Energy System Operator (NESO).**
- **The study shows that the key advantage of green gas is its year-round availability for back-up electricity generation when the wind does not blow and the sun does not shine, often when peak power is needed during dark winters.**
- **By diversifying the renewable energy mix to include more green gas, the energy system becomes more robust and resilient, and more likely to meet climate targets. The increased use of green gas will also ensure that no single technology is pushed to do too much, too fast, or too expensively.**
- **As CO_2 is separated during green gas production, it is cheaper to capture from a green gas plant than in other CO_2 producing electricity generation processes.**
- **Green gas is carbon neutral – its feedstocks arise naturally – so the capture of CO_2 in green gas production subtracts from overall emissions.**
- **Green gas (biomethane) is a direct replacement for fossil natural gas so there is a minimal retrofit of the existing gas system and it is easy to store and transport without new technology or operating risk.**
- **Green gas creates headroom within the net zero target allowing hard-to-abate industrial emitters more time to adjust at lower cost.**
- **The economy (including our home heating) continues to electrify but without the need for large over-capacity in offshore and onshore wind. The use of green gas saves £46.5 billion in capital spending on wind.**
- **Green gas can be generated throughout the country and can therefore supply local back-up electricity generation and make savings on new transmission lines.**
- **Hydrogen continues to play a key role in the net zero economy but a greater portion can be produced from green gas (biomethane) saving on energy losses that result from electrolytic hydrogen production. This results in hydrogen-related capital cost savings of £11.6 billion.**
- **Green gas also reduces the whole energy system costs, providing another important public benefit not captured by the market price. This in addition to decarbonisation.**

MEETING NET ZERO AT LOWER COST

This report is about saving money for British households and businesses, and about keeping the British economy competitive in an increasingly dangerous world. It shows that the British energy system can save £298 billion against the Government's (NESO's) 2024 Pathways to Net Zero (or PNZ, previously referred to as Future Energy Scenarios, or FES). This is equivalent to £415 every year for every British household over the period to 2050. These savings can be made while making Britain's energy more secure, because green gas is home-made. Moreover, we can be more confident of meeting our climate targets. Green gas can also save £22 billion in capital and operating costs over the next 6 years in meeting the Government's goal of a clean power system by 2030 - £133 a year for each British household.

What is net zero? The aim is for the UK economy to produce no world-warming emissions – whether from methane or carbon dioxide or other greenhouse gases – by 2050. However, the "net" is crucial. It recognises that there will be some industrial activities where it is so hard to reduce emissions that they will continue to do so, and those emissions therefore need to be cancelled out by activities that subtract emissions from the atmosphere. This subtraction could be through direct carbon capture, or through capturing natural greenhouse gases that would be emitted if left alone as part of the biogenic cycle.

Balancing the goals of policy, including net zero, is a feat of juggling. Energy secretaries face a trilemma between three competing policy objectives. One is the need for clean power to reach net zero, which was agreed by all the mainstream political parties in the revision of the climate targets in 2019 in one of the most overwhelming votes in British parliamentary history. The second is energy security: keeping us warm with our lights on in dark winters regardless of global events such as Russia's invasion of Ukraine and the consequent gas price rise. The third is cost: whatever is decided must be affordable, not just to home consumers (who vote) but also to the businesses that employ them.

This report does not challenge the net zero objective but looks again at whether we could achieve it more cheaply and more securely. The costs of the net zero transition are crucial not just to those paying their home energy bills – probably the highest profile and most sensitive bill any household pays - but also to businesses whose competitiveness and viability can be adversely affected, which will in turn curb investment and future prosperity if costs rise too fast and too far. Energy costs even if relatively small for particular businesses, are key to the economy as a whole. Success will in part be determined by relative energy costs compared with rivals.

Costs are also likely to be key following the election of President Donald J Trump. Whether or not tariffs are applied to British exports, as Mr Trump has promised, energy competitiveness will be crucial. We need help competing in the nearby European market too. If we were to waver in the progress to net zero, the European Union would certainly apply variable tariffs – levies – to equalise the cost of net zero energy. The EU Carbon Border Adjustment Mechanism (CBAM), though, will allow any country clearly meeting its net zero targets to compete openly. Countries that do so cheaply will have an advantage in the European market.

SO-CALLED LEVELISED COSTS OF ENERGY	£ PER MWh
Biomethane	**77**
Solar	**37.46**
Onshore wind	**36.89**
Offshore wind	**35.53**
Gas with CCUS	**147**
Nuclear	**57.27**

Note: These figures refer to Great Britain. Source: ADBA-BMA, derived from ADBA base case model run

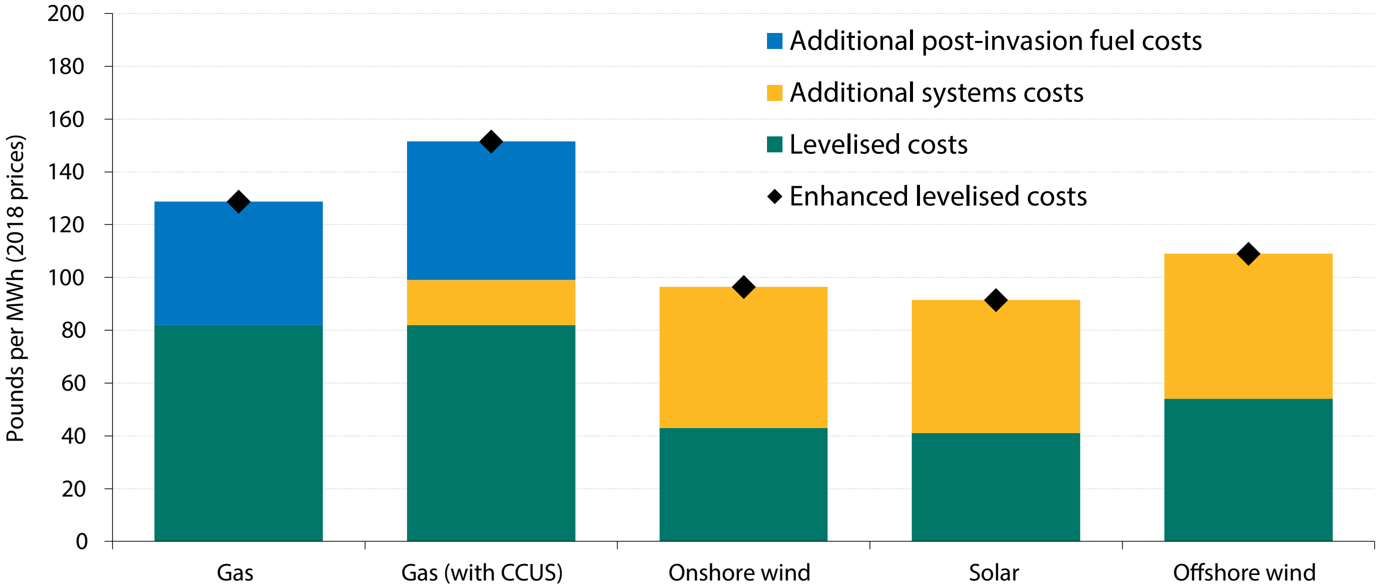
This research study compares the cost of the whole energy system in the Pathway to Net Zero (PNZ) commissioned by the Department of Energy Security and Net Zero (DESNZ) with a scenario that ADBA commissioned which uses more green gas. This whole system cost is crucial because the individual costs of particular sources of electricity – the so-called levelised costs of energy, shown in the table - do not give the whole picture: it is very cheap to produce electricity from solar or wind, but not at the time you need it. You need to add batteries to use that electricity flexibly in the short-term. But there is no battery cheap enough, or sufficiently scalable, to make it economic to charge up with July sunlight and discharge January warmth.

The Role of Green Gas in Net Zero

To provide electricity when winter evenings cause peaks in electricity demand for light and heat, you need to over-build wind to provide a margin of spare capacity and have expensive back-up using fossil natural gas with carbon capture and storage. In addition, there are system costs from new power lines and changes in technology. ADBA therefore wanted to test the proposition that dispatchable power – like that using green gas or biomethane – could reduce whole system costs by ensuring that there is energy when it is needed. In other words, the technology is cheaper than its levelised cost implies. Dispatchability is an important advantage that has public benefits in itself that are not captured in the simple cost to developers of energy per megawatt hour.

This issue of system and back-up costs is widely accepted. For example, the Office of Budget Responsibility (OBR) highlighted these back-up and system costs in a recent analysis published in the Fiscal Risks and Sustainability Report, July 2023, whose results are shown in the table here. The OBR did not itemise biomethane (or indeed nuclear power), but the chart compares the chosen technologies:

ILLUSTRATIVE ENHANCED LEVELISED COSTS OF ENERGY



Note: Additional systems costs are the mid-point of BEIS's high and low scenarios. In line with the literature, we have rebased these to be relative to a reference technology – the additional systems costs of gas. Additional fuel costs scales up BEIS's estimate of fuel costs in 2025 to account for the gas price in our March 2023 EFO forecast.
Source: BEIS, OBR https://obr.uk/docs/dlm_uploads/Fiscal_risks_and_sustainability_report_July_2023.pdf

The key reason why green gas saves money when building the whole energy system is precisely because it is dispatchable: it has the property of being easy to store (either by increasing the pressure in the gas grid or by putting it into underground storage facilities like the Rough facility built out of an old natural gas field in the North Sea). None of this involves new and untested technology. There is no new operating risk, since old tried and tested means are used.

Green gas is therefore easy to draw on and transport where and when it is needed. Combined cycle gas turbine (CCGT) electricity generators (which now run on fossil natural gas but can also run on biomethane) are the best form of backing up the power system, because they can be fired up quickly when needed, and ramped down again. CCGTs are relatively cheap to build, and most of the cost is the variable cost of fuel. This fuel cost is only incurred when the back-up is needed. They are ideally suited as back-up electricity generation in the system. By contrast, any technology – whether offshore wind or nuclear - which has a very high up-front capital expenditure and low running costs should be used as much as possible and whenever possible to amortise its cost and maximise the return on its investment.

The variability in the current gas consumption between summer lows (when gas is used mainly for cooking and industry) and winter peaks (when it heats our homes) is far greater than the swing in electricity consumption. Based on daily data, gas typically swings in northern countries by a multiple of six from summer to winter, and electricity doubles. The differences from trough to peak are even bigger using hourly data. As the economy gradually electrifies, a lot of this swing in gas consumption is going to transfer to the electricity grid, making back-up even more of an issue. That is what ADBA wanted to test in these projections.

There is one other key point in the projections: green gas plants typically produce a biogas which is about 50-60 per cent methane, and about 40-50 per cent carbon dioxide (CO_2). This CO_2 is naturally occurring in organic material. Capturing and storing this CO_2 leads to the whole process being net negative: it takes out of the atmosphere CO_2 that would otherwise be in the atmosphere. It subtracts CO_2. That net negative emissions in the green process helps to create room in the whole energy system for hard-to-abate emissions, and therefore saves more money. For example, buildings that are difficult for heat pumps can continue on low carbon gas. Some Heavy Goods Vehicles can continue to use liquid fuel.

So far, we have discussed the benefits of green gas in a net zero world, but there are also important transitional benefits that green gas provides. Because green gas is low carbon, its early introduction into the system means that we do not have to push any other technology too far or too fast. This more measured pace of transition for key and important technologies like electric heat pumps in our homes saves money, disruption and installation costs. The overall direction of our transition – electrification, hydrogen – does not change. But a lot of problems in policy are not about imagining the end goal, but about a sensible and workable pathway.

It is also important to note that this report does not measure the costs of net zero compared with doing nothing, because there are costs of continuing with the present system too. Any energy system needs constant investment to replace ageing equipment. Moreover, a system which was not transitioning to net zero would impose increasing costs through extreme weather events and increased insurance premia for homeowners and businesses. The recent flooding in South Wales is another reminder that these islands are not immune to the sudden intense downpours – months of normal rain in minutes – that can impose vast costs on business, households and the Government. Finally, a jettisoning of net zero as a goal would breach our international commitments in our nationally determined contribution to the United Nations climate process.

The comparison that we make in this study is therefore between the Government's Pathway to Net Zero and a scenario that adds green gas explicitly to the energy mix. The low scenario is the Government projection (in the biomass strategy) that green gas will ramp up from 8 TWh in 2024 to 35 TWh (compared with 705 TWh for last year's UK gas consumption). The high scenario is taken from Ecotricity's study (Green Gas: The Green Economy Under Our Feet, May 2022), which projected enough feedstock – including the growing of grass to feed biogas digesters – to provide 288 TWh. Finally, we have a base case built on ADBA's own estimates and those of industry leaders which is for a ramp up to 100 TWh. It is this middle scenario that makes savings of £415 per household and £298 billion overall in meeting net zero by 2050, and on which we concentrate most of the following discussion.

In addition to these net zero scenarios, we also look at the most economical ways of meeting the Government's new objective of a clean electric power system by 2030. Here we compare the Government's scenario with an ADBA scenario of more green gas (consistent with our net zero pathway). Once again, we show in this report that there are substantial savings to be made by ramping up production of green gas. The overall cost of the capital and operating expenditure for clean power is cut by £22 billion, equivalent to £133 for each British household in each of the next six years. Biomethane turns out to reduce system costs, and therefore provides a better deal for consumers and businesses.

It is also important to note that the pathway to clean power in 2030 is likely to be much more assured and robust with green gas. This is for two reasons. First, the energy system is more diversified, and less reliant on the success or cost of any one technology. Without green gas, some technologies must work so hard that their costs rise sharply as easy opportunities are exhausted. This adds to costs. Secondly, green gas can be built more quickly than most other zero carbon technologies. It would be impossible to build and commission any new nuclear power station by 2030, and even new offshore wind takes many years to plan and commission. By contrast, a biomethane injection plant can be built within three years, and ADBA has been pressing for ways in which even this relatively tight timeline could be shortened. The annexe to this report attaches the 10-point plan for accelerating the build-out of green gas.

WHY MODELLING?

Modelling makes sense when you are trying to analyse a highly complex system like energy, where there are so many relationships (between incomes and spending on energy, industrial use and gas and so on) that nobody could expect to understand them without a mathematical and computer representation – a model. Modelling also allows you to see how small changes can affect other parts of the system, like dropping a pebble in a pond and seeing how far the ripples go. There are many versions of our future, depending on our choices today, and it is important to understand the whole system to make sense of it.

Most important, the green gas – anaerobic digestion (AD) - sector has been largely overlooked in the UK both by policy-makers and analysts. True, there have been some very AD-focused support schemes like the present Green Gas Support Scheme (GGSS). In the past, there was the non-domestic Renewable Heat Incentive, Feed-in Tariffs and Renewable Obligation Certificates. However, the support schemes (with the exception of some support for transport use) have been time limited. Moreover, the system modelling and statements put out by DESNZ and the Climate Change Committee generally gloss over the whole sector impacts of AD. With this project we are aiming to rebalance this perspective.

We have chosen to work with Business Modelling Applications (BMA) because they have a sophisticated model (Decisio™) of the whole energy system that has been built on the basis of public and private data, and which uses some of the most advanced Artificial Intelligence techniques to probe and measure relationships between key factors (growth, energy saving, energy demand and so on). As a result, the model can account for the whole system costs and lay out the geographical and local implications. A further key consideration is that the Decisio™ model is agnostic about the most effective energy source or transmission mechanism and can assess the lowest cost pathway to net zero without constraint or bias.

The BMA Decisio™ model is also useful as it can be allowed to either find the optimum cost solution based on the cost and carbon intensities of different activities, or its results can be constrained to assume that known policies (such as the clean power objective by 2030) are taken into account. The additional benefit is that the model has already been tried and tested to sketch out the implications of the Pathway to net zero put forward by the National Energy Systems Operator or NESO (previously the Energy System Operator or ESO) and reviewed by the Science and Innovation for Climate and Energy directorate (SICE) within DESNZ. Therefore, we can make direct comparisons between the official Pathway to Net Zero and our own scenarios adding different amounts of green gas.

Methodology

We use the existing 2024 Pathway to Net Zero established by the science team and others at DESNZ as a base line, because it incorporates the informed guesses and assumptions of net zero policy-makers. Can we improve on their outlook and if so by how much? Our first scenario involves taking the Government's own targets for biogas – 35 TWh of biomethane availability by 2050 - which it is currently not modelling with its pathway. In order to see the impact, the model incorporated data from ADBA about the existing and prospective AD plants so that Decisio™ could model the green gas sector. We then examined the high ambition scenario from Ecotricity, and a middling scenario based on the feedstock analysis that we described above. A key result is that every scenario is significantly cheaper using green gas than without. Green gas, as expected, cuts system costs.

We also had to ensure, as with any computer model runs, that the outcomes were plausible in the real world. At times, for example, the model called for very rapid and large investments as soon as possible (essentially signalling that the quicker the change the more optimal it is), but in the real world investment and growth have to ramp up on a realistic pathway, taking account of the treacle introduced by the planning and permitting system, skill shortages and lead times on delivery of key equipment. So, we had to calm the model's ardour, but those were dampeners and not changes in direction. The key aim of this project is to explore the impact of biomethane on the net zero pathways the UK can take. The energy and carbon figures all arise out of the workings of the model – they are "attributional". None of the elements used in the model calculate savings based on a comparison with a counter factual – a case that has not happened. This means that all figures should be comparable.

We have also boiled down the difference in cost in each projection so that all the fixed and variable costs – capital expenditure, operating expenditure including where relevant fuel – are included. We have also allowed for the time value of money: we would all prefer to be paid our salary today rather than in ten years' time. Therefore, the value of spending in a future year is reduced by the interest rate payable between now and then (it is "discounted"). The discount interest rate is assumed to be the international real interest rate on government index-linked ten-year bonds which is about 2 per cent a year, and therefore all these overall cash flows for each scenario are brought to a net present value (NPV) as shown in the table. Because the model naturally generates cumulative cash values, the detailed descriptions of changes are in cash. The assessment of the Government's clean power target in 2030 is also in cash, but there will only be a small difference with the present value given the relatively short time period.

Constraints, Limitations and Scenarios

A core assumption is that we want to reach net zero for the UK, and to explore options using biomethane. Therefore, in all of the scenarios we assume that the target is net zero 2050. In all the scenarios we assessed, the new government target of clean power in 2030 (CP30) is used as a constraint: in other words, the pathways have to meet this objective as well as net zero in 2050. The only exception is the comparison Pathway to net zero, as this is the baseline run done for comparison to the declared government policies in late 2024.

We do not claim that this study is the last word: we very much hope that it is the beginning of a debate. There is much more work that can and should be done in future on refining these positions, particularly in analysing the feedstocks – food waste, sewage, manures and slurries, soil-replenishing rotation crops, industrial wastes and other agri-wastes - to represent the real world more accurately. The speed with which more feedstock is available, together with its location, is still changing. (For example, mandatory food waste collections by local authorities are rolling out at different rates). However, ADBA's work on feedstocks and AD green gas plants provides a far better dataset for this initial analysis than the existing data used for the underlying models of the energy system.

Although we have information about new and planned biomethane injection plants, the uncertainties about feedstocks (and policy) mean that we do not try here to predict where a new plant would be sited, and this is beyond the intended scope of this piece of work. To account for the increased injection of green gas into the grid, we have assumed that the existing list of injection points can expand to deliver this extra capacity. This may not always be the case, but it is frankly more plausible than assumptions that electricity generators can simply plug into the electricity grid given some of the very long waits that the electricity grid is citing.

Biofertiliser

Another area where we should flag the need for future work is biofertiliser, the digestate which is the residual product of the green gas process once organic matter has been rotted in a digester. We do not assess here the potential of digestate from anaerobic digestion (AD) to replace fossil derived nitrogen fertilisers. However, this is significant, representing potentially around 30% of current use based on the current industry footprint. This could be a major support to farming and begin to counter the cost risks of the introduction of a Carbon Border Adjustment Mechanism in 2027. Biofertiliser could be worth up to 35Mt of CO_2 per year. However, the encouragement of biofertiliser requires a deliberate policy to decarbonise farming, which so far no Government has been courageous enough to propose.

Feedstocks

For the scenarios we have assumed that the baseline represents the feedstock mix in the Government's biomass strategy. This covers organic wastes, and existing committed bio-energy land use. The UK has a mixed picture for biomethane production, with domestic and commercial food waste, sewage, manures and slurries, industrial wastes (such as brewing and whisky residues), farm wastes, green wastes, break/cover crops and dedicated energy crops being used for AD. Each of these classes has different energy content and availability, but most of them will be less harmful in terms of greenhouse gas emissions if processed through AD. The balance of feedstocks assumed in government impact assessments is 50% food waste, 20% dedicated crops, 20% agricultural wastes and 10% sewage. This is a reasonable representation of the state of the industry now and into the near future.

Currently around 36Mt of organic wastes (farm, food and sewage) are processed through AD each year. There are thought to be around an extra 10-20m tonnes of food waste potential from domestic and commercial sources, and this should be finding its way into AD as the new "simpler recycling" regulations come into effect. Break and cover crops grown as part of a soil-replenishing rotation offer similar expansion potential to food waste. Credible industry analysis points to an opportunity to deliver this expansion with no change in food production. This is based on the need to change the crop type in fields to maintain soil structure and control pests like black grass which reduce the yield of food crops.

Manures represent potentially another 70-90Mt of feedstock. However, much of this potential is likely to be best used on-farm for heat and power as the low gas yield and high water content makes them expensive and inefficient to move far. This is another scenario that has not been possible to represent in this model as the impact is spatial and small on an individual basis, but could in theory make many farms energy independent and remove a load from the grid. This could reduce the need for grid reinforcement and new pylons. When the Department of Environment, Food and Rural Affairs (DEFRA) comes up with a plan to reduce the 11 per cent of UK emissions from farming, on-farm AD will be a key to success.

The next point to bear in mind is that the UK is currently producing another 13TWh of biogas that is being used in combined heat and power (CHP) plants that were supported in early support schemes like Feed-in Tariffs and Renewable Obligation Certificates that have long been closed to new applicants, but are still running off. Some of these legacy plants are already closing as they cannot justify the cost of replacing worn-out equipment with so few years left of support. (ADBA has been pressing for a legacy scheme to avoid losing low carbon power).

But a key point for this study is that some of them can convert to biomethane injection in short order, providing a much steeper potential ramp-up in the supply even without the need to build new facilities or find new feedstock streams. A target of 30TWh of biomethane injection in 2030 is achievable, long before 2050, and would reflect the kind of growth rates seen in the industry after the introduction of the Renewable Heat Incentive (RHI) for biomethane injection.

Carbon Capture

We have assumed that green gas plants can access the transport and storage network for carbon capture (i.e., there is non-pipeline access). This is done at the same time as the electricity generation system is able to install carbon capture, because it is given access to carbon capture and storage (CCS) in the model projections. So, the model is able to compare and decide between the two. Commercial sales of CO_2 to fizzy drinks makers and others are ignored in the model, and only the national potential for carbon capture is considered as driver of change. There may be other options that displace fossil carbon and nascent industries like sustainable aviation fuel which could provide major off takers for this CO_2.

CARBON ABATEMENT WITH BIOMETHANE

Removing fossil carbon from the whole energy system is a challenge precisely because the energy density of fossil fuels makes them extremely useful and adaptable. Yet biomethane is a 100% drop in substitute for fossil natural gas since it is molecularly identical. The only difference is that it releases carbon that has been taken from the atmosphere during the growing period of the organic matter digested to produce the methane, rather than from the carbon deposits fossilised many millenia ago. This means it has a net zero impact on the atmospheric CO_2 concentration. There are some small process emissions to consider but these can be mitigated relatively simply.

As we noted above, anaerobic digestion produces a raw biogas with similar volumes of both methane and CO_2. To inject the methane into a gas grid, the CO_2 must be removed in a purification process which is standard in all biomethane injection plants. This CO_2 separation means it is relatively easy to capture the CO_2, providing a very low cost path to atmospheric carbon removals and carbon negativity.

Most of the 700TWh of gas – methane – used last year by Britain's energy system comes from fossil natural gas, but nearly 8TWh is made up of biomethane, which is effectively carbon neutral. That methane is mainly used for domestic heat, electricity generation and industrial heat. There are also various lower volume uses like transport fuels. The low fraction of the gas grid made up of biomethane and its interchangeability with fossil methane means that it is historically overlooked in models and planning. Despite this, the sector's growth rate of 14% in 2023-4 shows that this blind spot needs to be rectified. Here we turn to examine where addressing that 'blind spot' can make a significant difference.

Contrasting the Pathway to Net Zero With and Without Biomethane

The original modelling under the official Pathway to Net Zero (PNZ, and previously the Future Energy Scenario or FES) treated all methane as natural gas, rather than indicating a distinction in the carbon intensity of the biomethane and natural gas. This reflects the same blind spot in the UK Emissions Trading Scheme for the use of biomethane (where biomethane is penalised as fossil gas). Using the model, we have first established a baseline projection which follows the PNZ holistic transition scenario but includes the very conservative biomethane volumes from the DESNZ biomass strategy.

The next stop is the minimal biogas scenario, with 35TWh in 2050 as suggested by the biomass strategy. It shows that, even with this modest amount of biomethane properly accounted for, there is a saving of £154bn in total system costs (using, as noted above, the Net Present Value). This scenario also meets the Government's goal of clean power in 2030, which the original PNZ does not. Even a modest ramp-up of biomethane production to the goal that the Government sets in its biomass strategy can save money, achieve ambitious decarbonisation and open up new options.

NET ZERO BY 2050: KEY COST DIFFERENCES IN SCENARIOS

MODELLED SCENARIOS	GREEN GAS POTENTIAL TWh	TOTAL COST £blns (NPV)	DIFFERENCE FROM PNZ £blns (NPV)	DIFFERENCE IN % FROM PNZ
Pathway to Net Zero, PNZ 2024 (formerly FES)	**0**	**4083**	**0**	**0.0**
DESNZ biomass strategy - 'low green gas'	**35**	**3929**	**-154**	**-3.8**
ADBA baseline estimate - 'middling green gas'	**100**	**3785**	**-298**	**-7.3**
Ecotricity scenario - 'high green gas'	**288**	**3892**	**-191**	**-4.7**

Source: ADBA-BMA

On this scenario, hydrogen is cheaper to deploy because it can be made from biomethane using the steam reformation process with far fewer energy and conversion losses than electrolytic hydrogen. There is also more subtraction of greenhouse gases from the atmosphere because of hydrogen production that has carbon capture and storage: effectively the process saves CO_2 first with biomethane production, and then again by making hydrogen from a zero-emission methane. The lower carbon intensity of domestic and industrial heating allows for more flexible transitions and so reduce costs over the 25-year period. Biomethane buys time and options.

The Role of Green Gas in Net Zero

The best outcomes for cost savings from our test scenarios are around the central estimate of 100TWh in 2050, with a relatively gentle increase in capacity. This saves more than £298bn (Net Present Value). The biggest savings come from avoided CAPEX in domestic heating. Not needing to install heat networks, valued at over £40bn, coupled with a reduced requirement to bring forward electric heating systems, also saves around £40bn. There is a saving of 18 per cent in offshore wind investment, amounting to £36 billion, and a cut of 36 per cent in onshore wind investment by £10.5 billion. A CAPEX saving is also made in reducing the deployment of electrolysers to produce hydrogen, saving more than £20bn.

We also modelled the Ecotricity scenario of 288TWh, which is a maximalist use of biogas. The projection suggests that the savings from using biomethane begin to decline, and this scenario is more expensive than the 100TWh case. Why? Costs can often rise when the best opportunities have been exhausted. Businesses go for the most profitable projects first. The very large expansion in biogas in the Ecotricity scenario would entail the use of feedstocks like grass with very low energy intensity, and therefore higher costs. The summary table here sets out the four key scenarios that we have explored, and their implications for costs.

Domestic Heat

There have been several alternatives for replacing heat in our homes proposed by recent governments. The existing policy is focussed around moving from the use of gas fired boilers to electrical heating, particularly the use of air source and ground source heat-pumps. The attraction of heat pumps is that they have a very high efficiency, using approximately a third of the energy of a gas boiler. Other attractive and efficient systems for heating proposed include heat networks, fed from waste heat of nearby industry or large-scale heat-pumps.

We have looked at how the affordability of these fossil carbon abatement options compare with the three forecast levels of biomethane in the grid. The 100TWh scenario results in more electrification of heat in 2050 than the holistic transition from the PNZ. This comes largely at the expense of the heat networks that are factored into these policy decisions. The reduction in the net carbon content of the gas grid by introducing 100TWh of biomethane allows a more gradual transition of technology whilst still making the key decarbonisation gains needed in the 2030s. This saves money on CAPEX, as well as allowing the CAPEX to be delayed. It consequently delivers a system that is net zero compatible for home heat for £88bn less than the PNZ scenario. These savings are made because both the technology is cheaper to deploy and there is no need for a radical rebuild of the domestic housing stock and heat distribution infrastructure. Existing gas lines and electricity lines are sufficient to deliver the benefits.

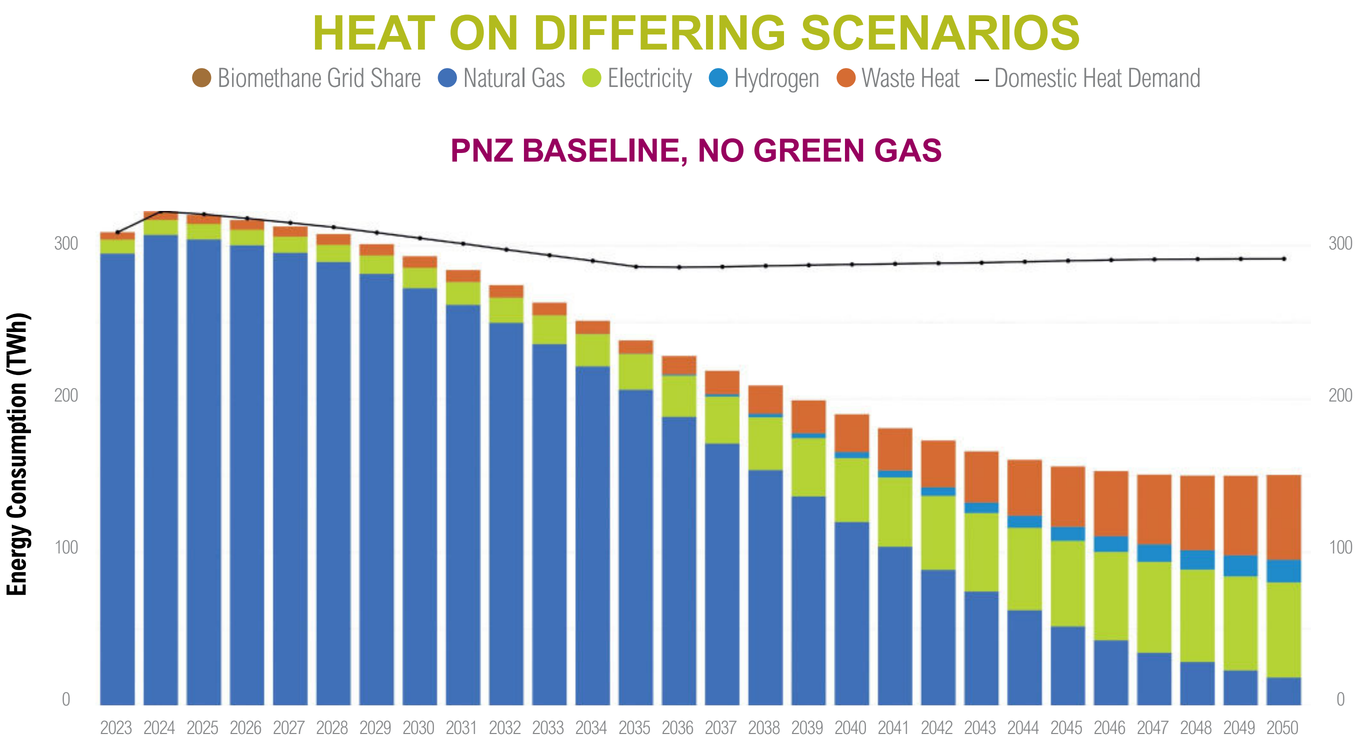


Figure 1. PNZ 2024 Holistic Transition domestic heat: Stacked bars show energy used to meet space heating demand (black line) in TWh, coloured by energy vector supplying the heat energy.

The model also shows consistent savings in operational costs compared to the core PNZ, as the infrastructure is easier to maintain compared to large scale hydrogen networks and higher capacity electricity systems. Fat methane molecules are just easier to move around requiring less demanding pipelines and appliances. A small amount of hydrogen is used in this scenario, but the quantities are small enough that the hydrogen can be blended into existing gas supplies safely without need for retrofits. Alternatively, it may be used locally where it is available from nearby industrial sources and their networks. Indeed, there is very little hydrogen heating until the late 2040s in this scenario, which also reflects the late switch over implied in the hydrogen supply charts. The ultimate penetration of electric heating is very similar to the PNZ and even rolls out a bit quicker after 2030. The main technology that is displaced is waste heat networks.

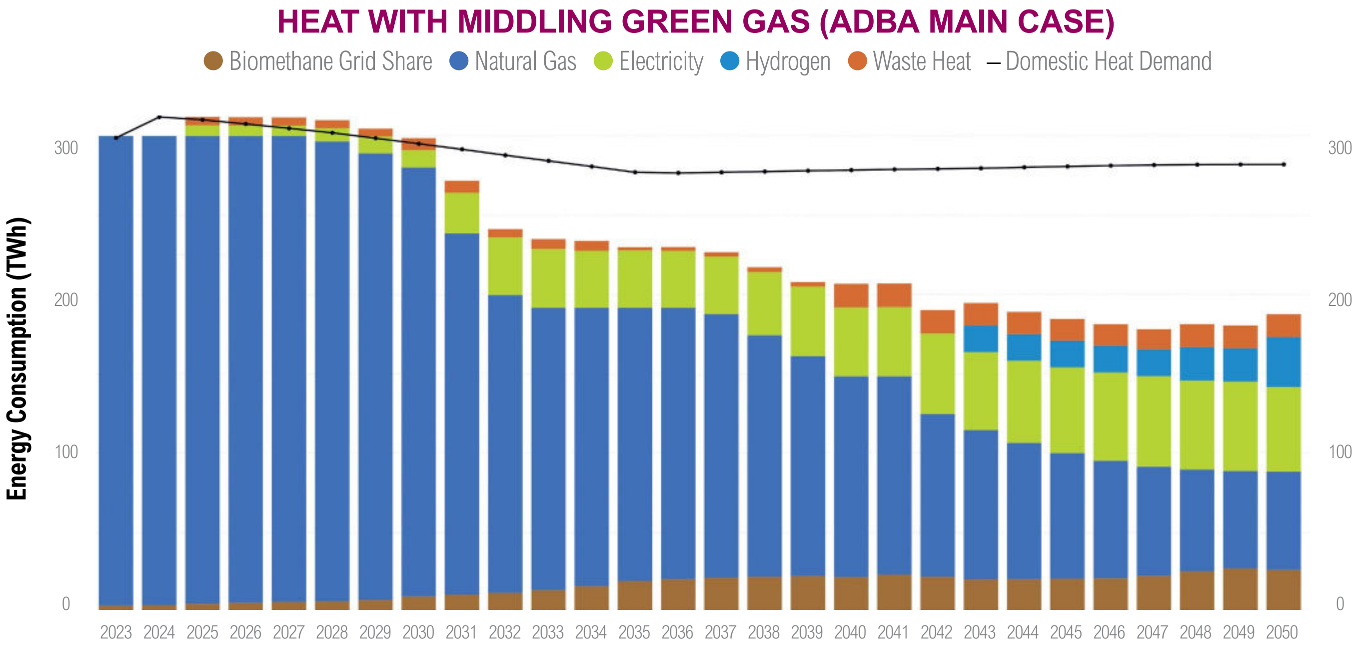


Figure 2. 100TWh Biomethane CP30 Domestic Heat: Stacked bars show energy used to meet space heating demand (black line) in TWh, coloured by energy vector supplying the heat energy.

Electricity Generation

Providing the system with access to more biomethane drives a greater, faster and cheaper decarbonisation of electricity generation. The reduction in the carbon intensity of the available methane means that existing Combined Cycle Gas Turbines (CCGTs) can continue in use for longer without the 20% energy penalty of fitting carbon capture and storage systems. Higher biomethane content makes industrial production of hydrogen for use in backup electricity generation more carbon efficient. These centralised hydrogen production centres using gas reformation technologies with process carbon capture and storage (CCS) can reach carbon negative intensities because of the increased availability of biomethane. These are real negative emissions not based on things like manure credits from avoided emissions, and they buy headroom in the system for hard-to-abate technologies.

Further cost savings flow with less new build nuclear energy overall and less grid reinforcement, because there is less overbuild to support use of renewable energy generation. These savings amount to £46bn in avoided overbuild of on-shore and off-shore wind, a relatively modest £2.5bn in reduced total nuclear capacity late in the modelled period and £3bn saved in grid distribution reinforcement. These are major long-term savings and particularly reduce, but do not remove, the UK exposure to critical minerals prices. Interestingly both the 100 and 288TWh scenarios see an increased investment in carbon capture and storage as this generates the negative emissions that allow other sectors to move at a more financially and technologically beneficial pace.

Industrial Applications

Industrial processes often need a constant, much higher temperature than domestic heat, which makes them harder to electrify. Processes like glass and ceramics manufacturing can be electrified, but this usually requires a larger space or smaller capacity kiln. It is thus far more expensive than direct heating, currently based on natural gas. There are other chemical processes, particularly in pharmaceuticals, from which it is hard to remove the high-end heat. In some cases, the gas is needed for chemical reactions as well.

These industrial systems take up more than a tenth of the UK gas consumption and are among the hardest processes to decarbonise by replacing fossil gas. By increasing the availability of biomethane, these processes have more time to adapt and shift to electrification or hydrogen use where appropriate. Even with this, some areas remain using methane in 2050, but given the forecast gas mix in 2050 is around 50% biomethane based on the 100TWh scenario the carbon footprint is radically reduced.

Hydrogen Production and Uses

In all scenarios there is hydrogen use for industrial and heating applications as well as production of electricity. One of the major attractions of the use of hydrogen is that it is zero carbon emission at the point of use. The most common production method is through gas reformation (steam methane reformation). To be net zero, the UK plans to use carbon capture and storage (CCS) on large scale gas reformation plants to convert methane into hydrogen. The 100TWh scenario shows that the carbon captured from this conversion is largely removed directly from the atmosphere. The process does not just reduce emissions: it subtracts from existing greenhouse gases.

The hydrogen made this way is carbon negative, and can be used for any application suitable for hydrogen. Much of this goes to electricity production by means of Combined Cycle Gas Turbines (CCGTs). With CCGTs burning a high biomethane content, there is very little need for the energy sapping carbon capture and storage for post combustion capture.

This means that the hydrogen production for CCGTs show a saving of £11bn on the ADBA scenario (compared with the PNZ) and £12bn on the Ecotricity scenario. The changes in the production pathways for hydrogen are also interesting between the different scenarios. When allowed to choose the mechanism of production, and given some biomethane as a feedstock, the model moves to much higher levels of thermal production, based on steam methane reformation with CCS. This kind of gas reformation represents the most established method of hydrogen production and one of the most effective at bulk production. The net efficiency of gas reformation at 65-75% is significantly more than the 50% efficiency found in the conventional alkaline electrolyser pathways.

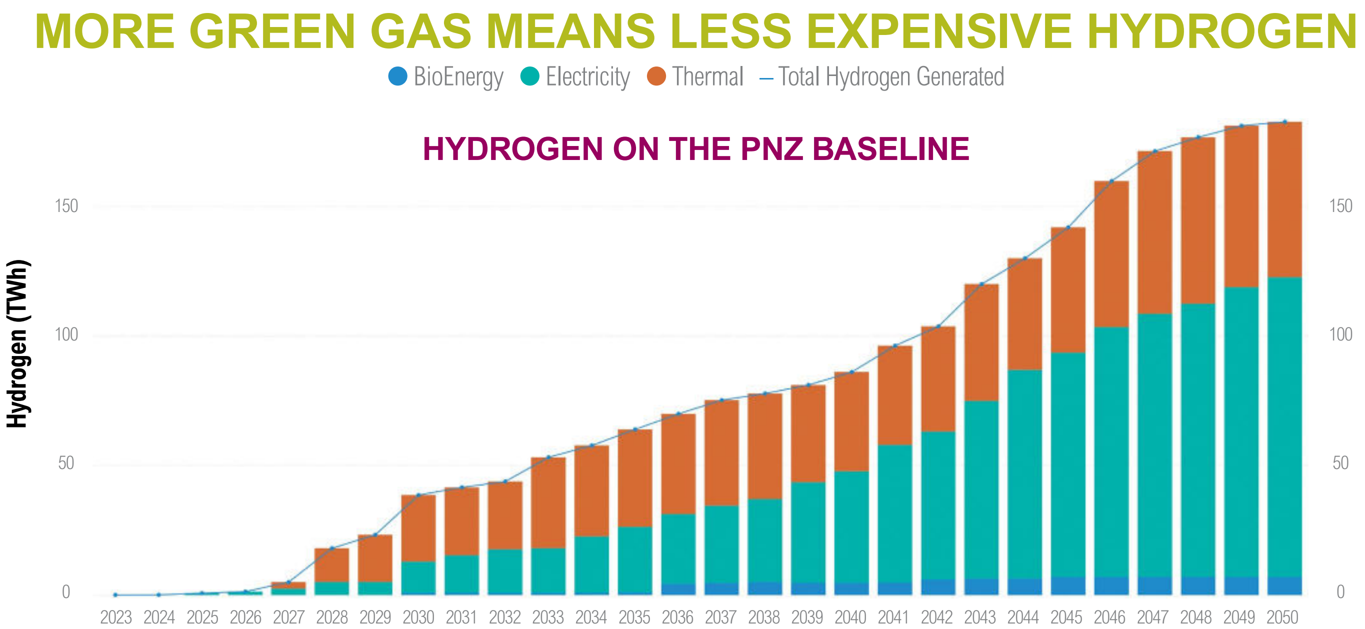


Figure 3. PNZ assumptions on hydrogen production without biomethane in 2024, PNZ 2024 Holistic Transition.

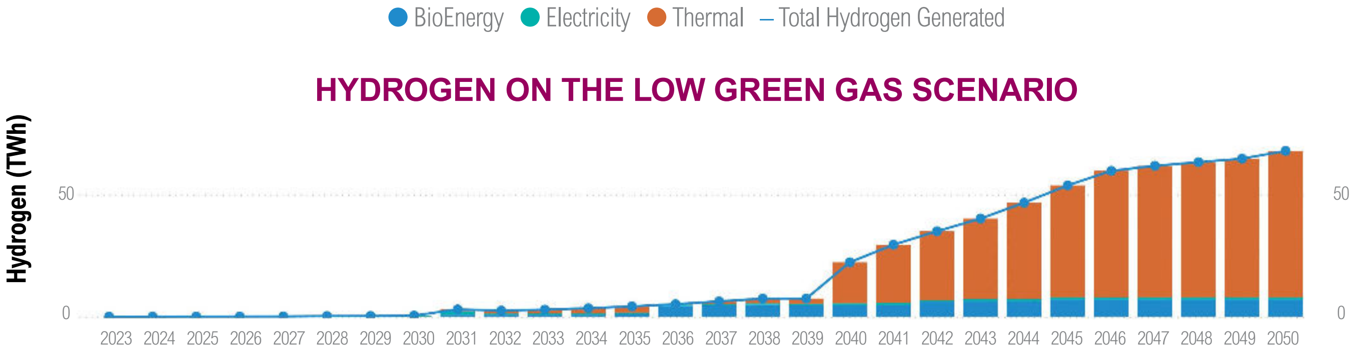


Figure 4. 35TWh Biomethane CP30 - hydrogen production, ADBA-BMA

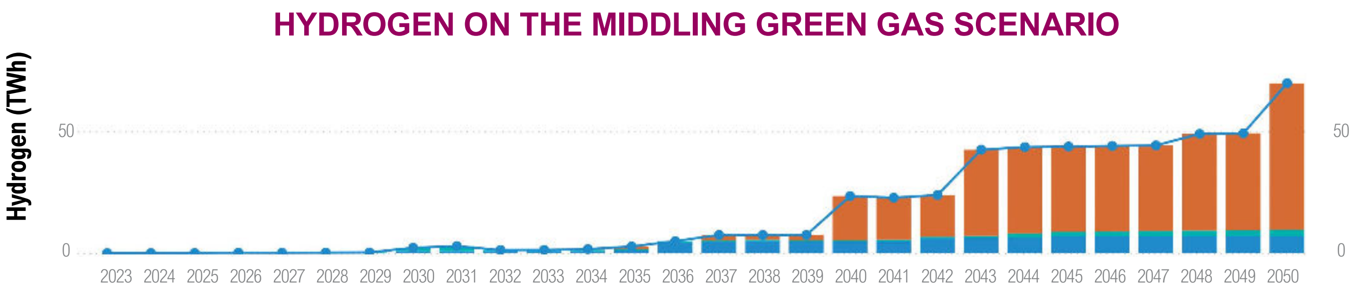


Figure 5. 100TWh Biomethane CP30 - hydrogen production, ADBA-BMA

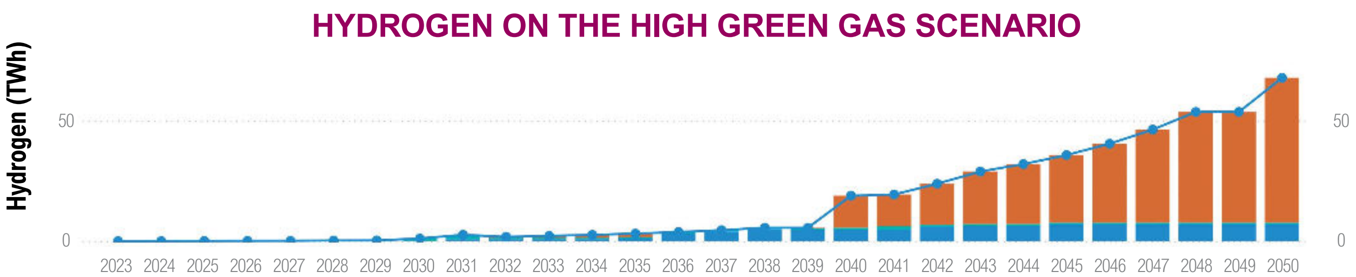


Figure 6. 288TWh Biomethane CP30 - hydrogen production, ADBA-BMA

In principle, electrolysers are an attractive technology for buffering the inevitable excess energy produced from renewables on sunny and windy days. The resulting hydrogen is a much more economic way to store energy for inter-seasonal use than a battery. However, the main ADBA green gas scenario shows savings in spare renewable energy capacity, which means less curtailment of low-cost electricity for powering electrolysers at an economical rate. Decisio™ whole energy system modelling opts for biomethane, which offers advantages over hydrogen for seasonal storage. Biomethane is easier and cheaper to store due to its compressibility.

Each of the different biomethane scenarios has subtly different profiles but in all cases the total volume of hydrogen production is lower than in PNZ and skewed further to the more efficient and cost-effective thermal processes and away from electrolytic hydrogen. With the extra volumes of biomethane, these flows are increasingly carbon negative as CCS is included in the model for all thermal hydrogen production.

The Role of Green Gas in Net Zero

Uses of hydrogen differ between the non-biomethane and the 100TWh biomethane scenarios. These are probably the most instructive differences. The 100TWh of biomethane scenario uses just one third of the hydrogen in the PNZ. It also pushes that hydrogen into electricity generation through hydrogen-powered gas turbines (CCGTs). This is dispatchable and carbon negative due to the high bio-component in the hydrogen production process, so it uses around double the hydrogen for electricity in 2050 compared to the PNZ. But very little hydrogen is allocated to industrial heat demand in this scenario.

BIOMETHANE CAN DO THE SAME AS HYDROGEN

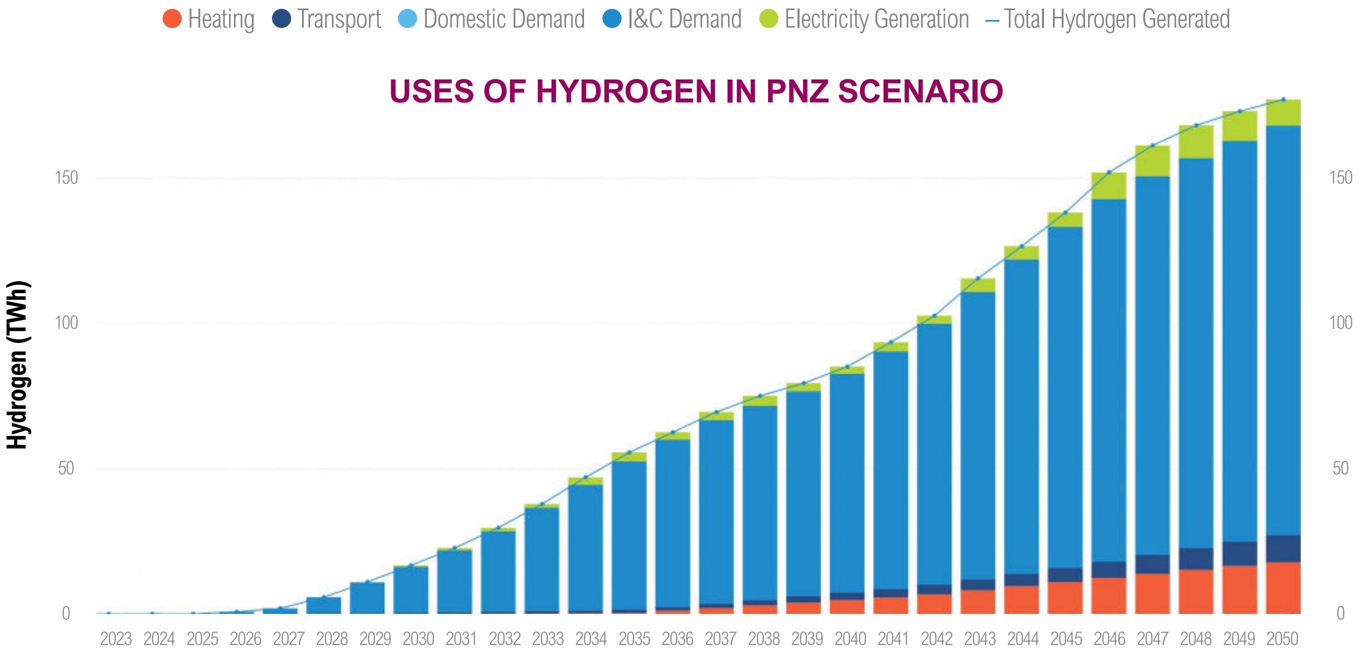


Figure 7. PNZ hydrogen applications, PNZ 2024 Holistic Transition

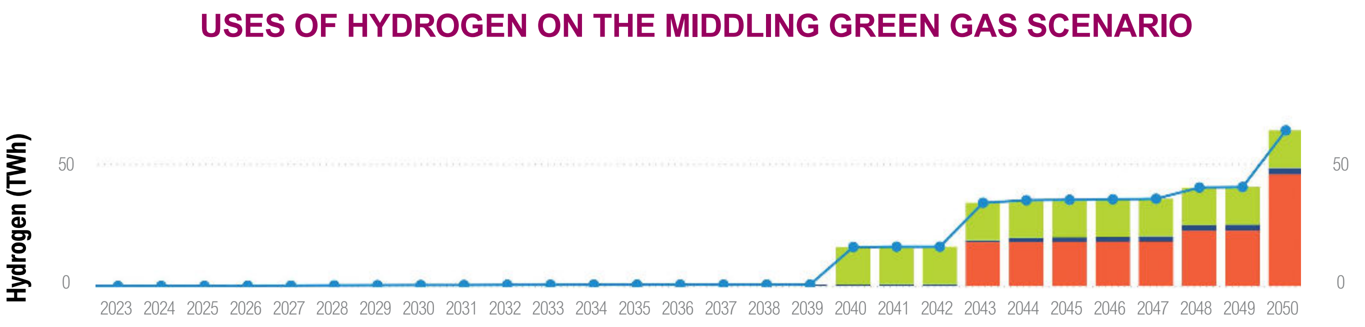


Figure 8. 100TWh Biomethane CP30 hydrogen applications, ADBA-BMA

Transport

The cost of grid reinforcement for the charging needed to support transport electrification is extremely high. This is particularly the case for the megawatt chargers needed for fast charging heavy trucks. The ADBA100TWh biomethane scenario creates sufficient carbon savings to allow for slower electrification of heavy vehicles, and so a lower impact on the short-term investment when the technology and supply chains are not ready for mainstream adoption.

The availability of carbon removals from the extensive deployment of AD buys even more time and space to reach net zero in transport. Consequently, the model decides that it does not need to phase out liquid fossil fuels entirely. Again, biomethane is buying the economy time to adjust at lower cost and allowing hard-to-abate technologies to continue longer (or in some cases probably indefinitely).

Using biomethane in trucks is more cost effective for certain operators now. The Department for Transport report analysis shows that there are pollution benefits to running dedicated gas trucks, and these increase with tighter particulate regulations.[1] Trucks running on biomethane cost around 30% more than a diesel truck and around half of a battery truck. It is likely the model is underestimating the potential penetration of these gas trucks and so also underestimating the decarbonisation speed of commercial transport. The most interesting factor is that there is very little hydrogen penetration into the transport fleet in this base case biomethane scenario. There is simply less hydrogen employed right across the economy, although the early implementation of hydrogen happens mainly in transport in all of these scenarios.

EFFECT ON TRANSPORT IN DIFFERENT SCENARIOS

Liquid Fossil Fuels ● Natural Gas ● Electricity ● Hydrogen

TRANSPORT FUELS ON PNZ SCENARIO

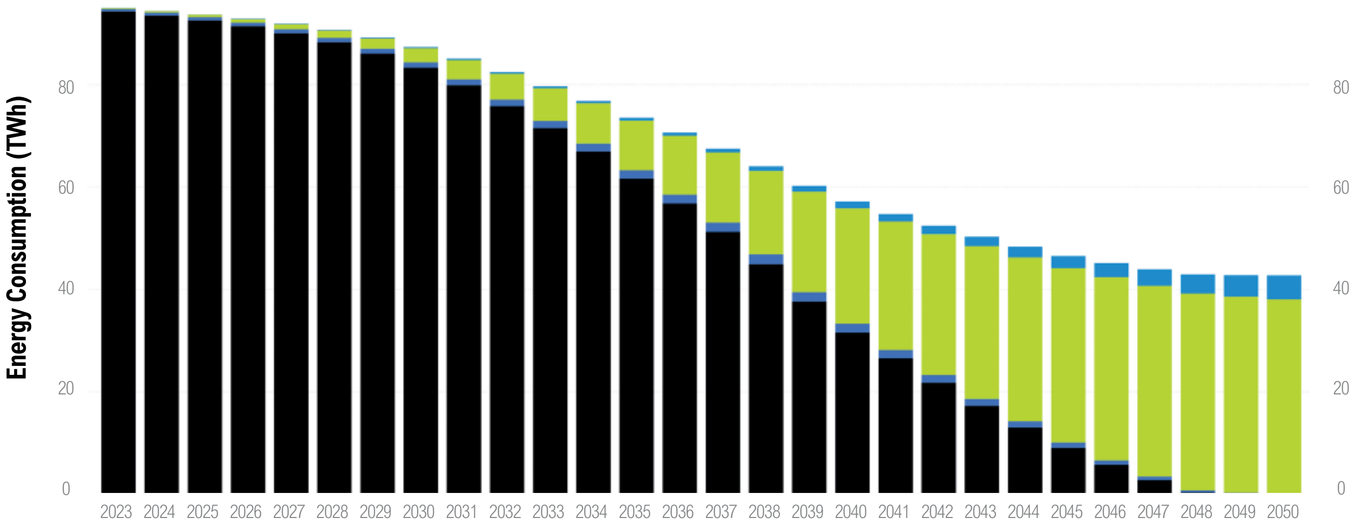


Figure 9. Commercial transport, PNZ 2024 – Holistic Transition

TRANSPORT FUELS ON MIDDLING GREEN GAS SCENARIO

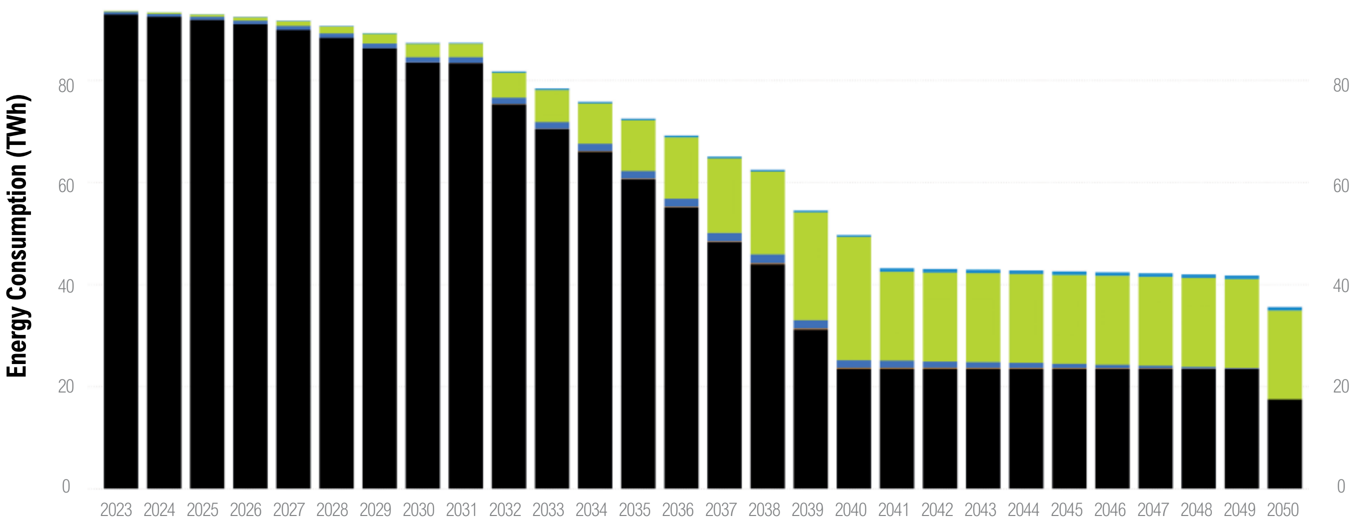


Figure 10. 100TWh Biomethane CP30 transport scenario, ADBA-BMA

[1] https://assets.publishing.service.gov.uk/media/5a803c7f40f0b62305b89fa9/emissions-testing-of-gas-powered-commercial-vehicles.pdf

Domestic transport is not much changed by biomethane, as it is constrained by the policy of reaching zero fossil fuels by 2050. Even so, the process follows a very similar trajectory with the PNZ and the ADBA 100TWh scenario.

Nuclear vs Biomethane

We cannot realistically reach net zero on a tight timeline without all technologies pulling their weight. So there is space for a multiplicity of energy sources, energy saving and demand management. What is incontrovertible, however, is that if we follow the middling green gas 100TWh biomethane scenario, biomethane becomes a large and highly valuable part of the energy mix. Just in terms of energy output, biomethane would overtake nuclear power from 2035 to 2038 and again after 2045. It is not, of course, a race. But the sheer scale of biomethane should make policy-makers think about the resources and effort put into the sector's growth compared with, say, hydrogen and nuclear.

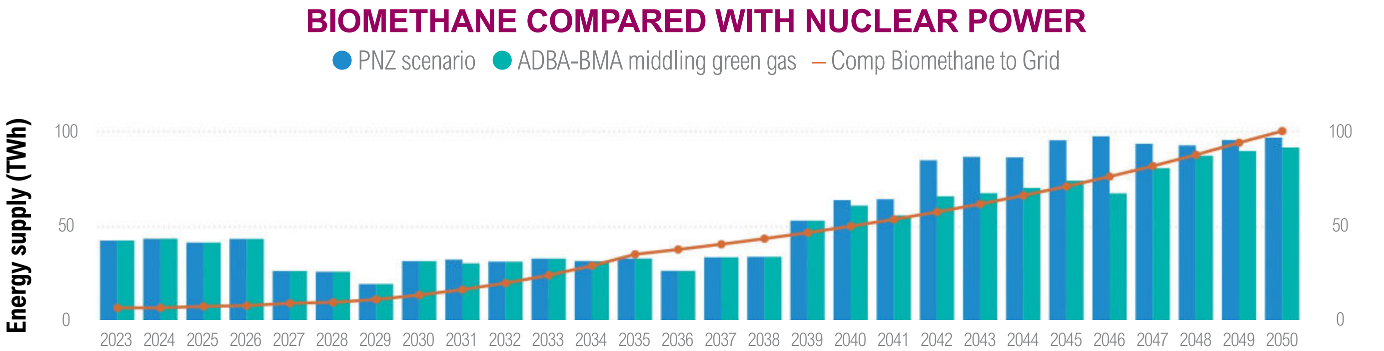


Figure 11. Comparing PNZ 2024 Holistic Transition with ADBA-BMA 100TWh Biomethane CP30 scenario

Extensive Carbon Negativity

Using carbon capture on anaerobic digestion plants provides great potential for active carbon removals at a fraction of the cost of post combustion carbon capture and storage.

The potential for greenhouse gas removals on a 100TWh biomethane system is around 14Mt/year. The investment needed for carbon removal from a 75GWh biomethane plant (~1,000 M^3/h) is approximately £2.4m, and capable of removing around 10Kt of CO_2/year. The operational costs of this are in the order of £50,000. Overall, this cost can be explained as 1Mt of CO_2 for the UK's current biomethane injection capacity costing £240m to install and £5m a year to sustain.

This compares favourably to the cost per megaton of the recently announced CCS investment which is presented as £22bn of investment to deliver 8Mt/year of carbon capture[2]. This ratio suggests that the cost of the carbon capture in AD is around 1/10th of the post combustion CCS that the Government has proposed. Moreover, the CO_2 sourced from anaerobic digestion has a positive impact in atmospheric carbon removals, assuming it is placed into permanent storage.

Even if we assume that the UK only produces the biomass strategy estimate of 35TWh of biomethane, that production represents 5Mt/year of CO_2 removed from the atmosphere whilst also creating energy.

The chart here shows the fundamental benefit of using biomethane is the ability to cheaply capture and store the CO_2 from the AD process. The negative emissions created from this allows much more flexibility in other sectors to more cost effectively decarbonise. We compare again with the PNZ, which essentially needs every sector to hit zero emissions by 2050.

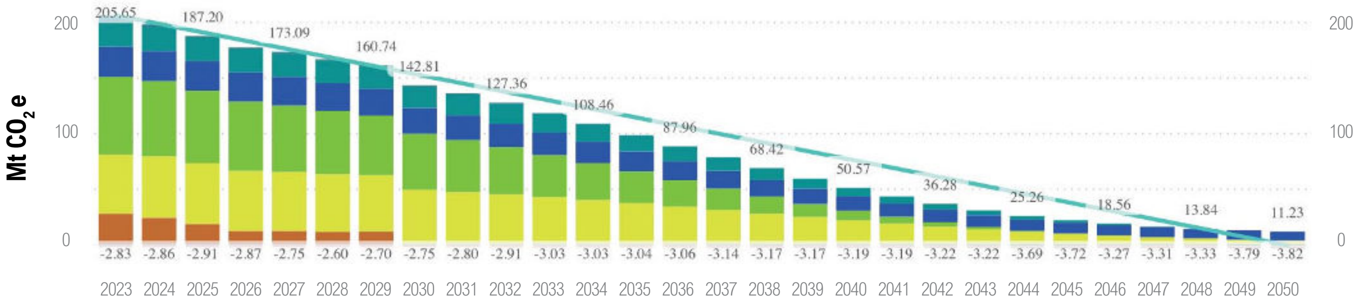
If biomethane is deployed at the100TWh scale and the rest of the systems succeed in hitting the PNZ proposed level of decarbonisation, then the UK can reach net zero sooner and even be carbon negative as an economy. Either way, this provides options to the UK economy. Biomethane allows for slippage and hard-to-abate laggards, and is therefore more likely to support a robust pathway to net zero.

[2] www.bbc.co.uk/news/articles/cy4301n3771o

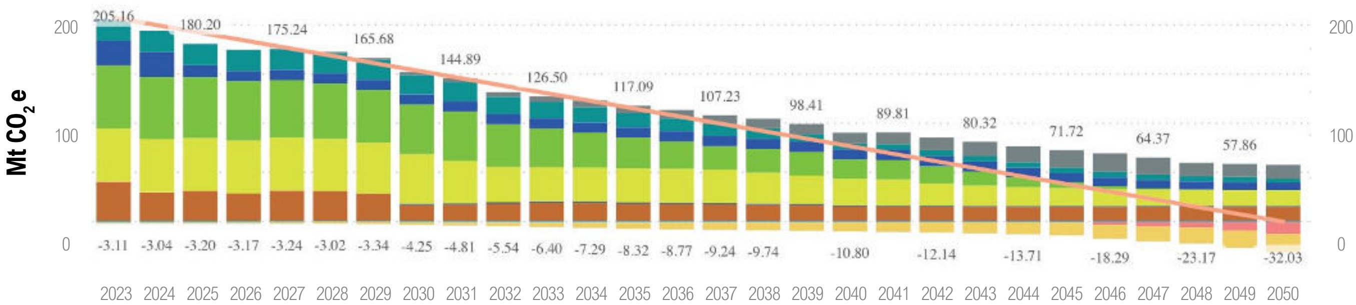
NET ZERO PATHWAYS

● Anaerobic digestion – CHP ● Biomass & energy crops ● Biomass gasification ● CCGT (combined cycle gas turbines for electricity generation)
● CCS (Carbon Capture & Storage) retrofit (to CCGTs) ● DACCS (Direct air capture carbon capture and storage) ● Domestic heat
● Domestic transport ● Gas To Grid (biomethane carbon capture from AD) ● Industrial & commercial heat ● Industrial & commercial transport
● Industrial energy ● Non-renewables ● OCGT (open cycle gas turbines for electricity generation)

EMISSIONS ON PNZ SCENARIO



EMISSIONS ON MIDDLING GREEN GAS SCENARIO



We have focused on the implications of the ADBA 100TWh by 2050 scenario but we also tested the scenario put forth by Ecotricity (288TWh of green gas). When given the option of this level of feedstock, the model opts to deploy a lot of it quickly to help meet the target of clean power by 2030. Then there is a spike to 62TWh in the mid/late 2030's in time for the end of Carbon Budget 6, but subsequently a retreat in the use of biomethane. This would be a poor use of resources, and the stop-start process is debilitating as the industry discovered in the last ten years. The model chooses to use the biomethane unused in the grid for electricity generation and drives even more rapid decarbonisation of electricity displacing woody biomass combustion. Given the amount of gas available there is a slightly lower penetration of domestic electric heating and more retention of gas heating. The rise in costs because of such a large deployment of biomethane is, though, unlikely to recommend this policy option to ministers.

UK Economic Benefits of Biomethane

Biomethane is the only renewable technology that is consistently sited in poorer, more rural regions of the UK, as DESNZ has pointed out in its biomethane consultation. This provides a more even distribution of the benefits of net zero and supports the levelling-up agenda. Much of the work that is needed in the build out of new biomethane plants can be done by local construction firms. Certainly, there are very specific skills and jobs associated with siting and constructing new plants, but there is less of a supply bottleneck compared to the specialised ships and technicians needed to install offshore wind turbines.

The wide availability of the skills needed for AD construction allows for faster build out and more evenly shared investment benefits. This distribution can also accelerate the training and qualification of a new larger cohort of construction workers to match to the Government's desire for home building expansion and other infrastructure goals.

There are also opportunities to develop export-oriented skills and expertise, since the rapid growth of biogas and biomethane is just beginning if the International Energy Agency forecasts (of 8 to 26 per cent a year growth) are correct. In particular, AD plants are now being installed in the traditional manner without taking advantage of carbon capture, and the UK could potentially have a first mover advantage if it pioneered the deployment at scale of biomethane with carbon capture and storage. As the difficulties of transition come into focus, more and more countries will want the benefits of relatively low cost technologies that can deliver energy while being net negative for emissions, and can therefore buy the time and headroom to reach net zero more cost effectively.

There is another policy motive. A key benefit of biomethane production with carbon capture is that it creates a stream of bio- CO_2 that is suitable for use in sustainable aviation fuel production, something that is consistent with demands placed on the UK economy by government policy in the form of the SAF Mandate. Rising demand for low carbon sources of CO_2 for making energy derived fuels after 2028 will require supply to match. Biomethane upgrading offers the most cost effective solution to this problem.

If we accounted for the on-farm manure processing, energy generation and biomethane upgrading there are a number of excellent UK based micro-modular AD producers who can benefit and grow to export scale, suitable for many rural parts of the global economy. This would also have the co-benefit of reducing the import of fertilisers, and effectively producing localised energy resilience in the hardest to reach parts of the UK. The review of the energy pricing policy can help build local support for these systems and the domestic supply chain.

CONCLUSION

We have shown in this exercise that there is scope to significantly improve the net zero transition by reducing costs and properly accounting for the potential of biomethane's contribution. As a nation, the UK can use this potential either to go faster or to de-risk more demanding carbon budgets. Alternatively, Britain could stick with the existing level of ambition but in the knowledge that carbon budgets and the ultimate goal of net zero in 2050 could be met with more certainty and at a lower cost. The key point here is that the addition of more green gas to the energy mix gives policy-makers more choices and options, and makes them less reliant on unproven technologies delivering what they promise.

The diversification of the energy mix with more green gas also means more likely progress, less dependent on the particular trajectory of a handful of technologies. Diversification reduces risk. It also reduces the need to over-expand particular energy sources into higher cost investments, simply because all the most profitable and attractive projects have already been developed.

The comparison of these scenarios shows how substantial the savings from this process can be, whether in removing the need for hydrogen in most heat applications through the increased electrification of industrial heat, or through the removal of the need to over-build intermittent renewables to ensure security of supply. The nightmare for European energy ministers in particular is a scenario where the energy system is unable to ensure security of supply, whether of light or warmth. Green gas makes that scenario much less likely.

Above all, this study shows that more green gas improves every energy minister's trilemma. Security of supply is improved. Net zero is met with more assurance. And both those objectives are combined with greater affordability, as the overall cost of the energy system is reduced.

ANNEXE

Mission Biogas; ADBA's 10-Point Biogas Roadmap

#1 Build 1,000 new biogas plants to shield consumers from sky-high prices

As we saw following the Russian invasion of Ukraine almost three years ago now, the UK is at the mercy of fossil gas prices. In early 2022, gas prices soared to a peak of 642p/therm, sending us into a spiralling energy crisis and a scramble to reduce our reliance on Russian gas imports. Insisting that green gas makes up part of gas supply and backing new plants with green gas contracts for difference, would protect consumers and increase energy security. We can build 1,000 new biogas plants by 2030 to protect us all from sky-high energy prices.

#2 Keep supermarket shelves stocked by using UK-made biofertiliser

Synthetic fertiliser is made through the energy-intensive Haber-Bosch process which requires large amounts of fossil fuels. Alongside the rise of oil and gas prices, synthetic fertiliser prices have risen, too. Moreover, synthetic fertiliser is a significant contributor to soil health degradation and the disruption of the vital Nitrogen and Phosphorus cycles. Digestate, a nutrient-rich biofertiliser, is one of several valuable AD byproducts. By substituting synthetic fertiliser with biofertiliser and increasing market support for its use, we can close the loop of the circular economy, protect farmers against volatile prices of synthetic fertiliser, and increase UK food security by keeping food shelves stocked.

#3 Clean up our rivers and beaches by treating farm waste with AD

AD can help tackle water pollution and keep our waterways clean. Agricultural waste is often improperly disposed of and managed. Run-off of nutrients, pathogens, and contaminants from animal farms leads to dangerous pollution which causes eutrophication, dead zones, and disruptions to biodiversity. On-farm AD provides a closed-loop system for properly storing and recycling animal waste. On-farm AD is a win-win-win that protects our waterways, offers solutions for livestock waste management, and provides farmers with essential green gas energy to keep their farms running.

#4 Create 18,000 new skilled jobs across the UK

Number four addresses jobs and the growth of the sector. The IEA published its Annual Energy Outlook for 2024, forecasting that the biogas sector will grow anywhere between 8 and 26% a year by 2030. At the minimum, that would forecast 500 new plants creating home-grown green gas. It is already apparent how quickly AD can be scaled up and new plants can be brought online. At ADBA, we are calling for the development of at least 1000 new plants in that time, and with it, creating 18,000 new skilled jobs across the country.

#5 Stop the Emissions Trading Scheme penalising green gas

Notorious methane is a fast-acting greenhouse gas that heats the atmosphere at considerably higher rates than CO_2. However, the UK Emissions Trading Scheme (UK-ETS) penalises biomethane as if it were fossil gas, meaning that no greenhouse gas mitigation benefits are being offered to biogas plants, which abate methane emissions. Therefore, we are calling for allowances to stop penalising green gas.

#6 Pledge to establish a plan to decarbonise farming and use farm wastes

Farming is too important to ignore in our effort to decarbonise. Using the energy stored in farm wastes is key. Agriculture is responsible for considerable amounts of the UK's overall greenhouse gas emissions, at 11% in 2020. Even more dramatically, agriculture contributes to 69% of the UK's nitrous oxide emissions and 48% of its methane emissions, two powerful greenhouse gases with global warming potentials significantly higher than CO_2. The CCC has already acknowledged that AD is a necessary part of agricultural decarbonisation. Now is the time to act.

#7 Ease local planning with guidance to every local authority

Local planning must be eased through guidance to every local authority. Many local authorities have never approved a green gas plant before and are unfamiliar with the process. Thus, we are calling upon the government for its support in acknowledging AD as a vital part of reaching its net zero goals. To do that, it must issue standardized guidance to councils on new AD plants, treating them as the critical infrastructure they are.

#8 Ease permitting and grid connections

Permitting delays are amongst greatest challenges for the industry. The process at its slowest can take several years. To change that, the Environment Agency and other permitting bodies need adequate funding and staffing. Our eighth point calls for a streamlined permitting process through increased funding to slash these permitting delays from years to months and increase application approvals overall. Connections to the gas and electricity grids must be made as easy as possible to develop the green gas industry fully. This is essential for new plants. ADBA stands four square with other renewable organisations in pressing the government to boost investment in our grid infrastructure to ensure that the most value can be extracted from green gas.

#9 Ban food waste going to landfills and mandate weekly food waste collections

The UK produces millions of tonnes of food waste each year. Too much still goes to landfill. Defra's recently backed separate food waste collections in the coming years, but this process has been pushed back continuously. After a series of broken promises leaving local authorities expectant and disappointed, we need to be staunch in our position that this roll-out sees no further delays. There should be absolutely no food waste going to landfills, and this valuable feedstock should be taken advantage of by sending it to be recycled through AD to produce valuable green gas.

#10 Curb climate change from powerful methane

Methane is a powerful greenhouse gas with a shorter atmospheric lifespan than CO_2 but a much higher global warming potential. The temperature response of methane is incredibly dramatic over a short period of time, compared to carbon dioxide which warms slower but lingers longer. Many of the previous ten steps demonstrate how AD can mitigate methane emissions by preventing the gas from being emitted from rotting organic wastes. By scaling up green gas, we can ensure that the UK meets its Global Methane Pledge goals and help curb climate change by stopping methane in its tracks.

ADBA | Anaerobic Digestion and Bioresources Association | THE ENERGY BEHIND THE AD REVOLUTION adbioresources.org

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