



Department
for Transport

Pathway to net zero aviation: Developing the UK sustainable aviation fuel mandate

A second consultation on reducing the
greenhouse gas emissions of aviation fuel
in the UK

Department for Transport
Great Minster House
33 Horseferry Road
London
SW1P 4DR



© Crown copyright 2023

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit www.nationalarchives.gov.uk/doc/opengovernment-licence/version/3/ or contact, The National Archives at www.nationalarchives.gov.uk/contact-us.

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is also available on our website at www.gov.uk/government/organisations/department-for-transport

Any enquiries regarding this publication should be sent to us at www.gov.uk/government/organisations/department-for-transport

Contents

Ministerial foreword: Baroness Vere of Norbiton	6
Executive summary	8
Context	8
Summary of consultation content and proposals	11
How to respond	16
Freedom of Information	16
1. Introduction	18
The role of SAF in achieving net zero aviation	18
Potential for SAF to deliver green jobs and growth	19
The UK's SAF strategy	20
The purpose of a SAF mandate	20
Previous consultation and aim of this consultation	21
SAF mandate legislation	22
Timeline	22
2. Targets and price support for SAF	23
Updated analysis to inform targets	23
2025 target and trajectory to 2030	25
Setting increasing targets into the future	29
HEFA cap	33
Power-to-liquid (PtL) mandate	36
How the SAF mandate provides price support for SAF	39
Buy-out price	39
Mandate review points	44
3. Eligible fuels and sustainability criteria	46
Fuel types	46

Definitions of fuels	48
Waste assessment	49
Land criteria	50
Electricity criteria	50
Use of hydrogen in SAF production	52
Minimum carbon intensity reduction	54
GHG emissions calculation methodology	56
Non-CO2	58
4. Involved parties	60
The Administrator	60
Obligated parties and obligated fuel	61
End point of chain of custody	65
Threshold amount below which fuel is not obligated	66
5. Calculating the obligations and certificate reward	67
Obligation period	67
Suppliers' obligations will be determined according to the amount of energy supplied through aviation fuel	68
Tradeable certificates will be used to demonstrate compliance	69
Calculation of obligation	69
Calculation of certificates	71
Discharge of obligation	78
6. Submitting claims, reporting the required data, and fulfilling the SAF obligation	80
Provision of an IT system to facilitate administration of the scheme	80
Requirement for each obligated party to have an account	80
Submitting claims for SAF certificates	81
Carbon and sustainability information	82
Validating fuel amount information	83
Awarding certificates	84
Transfer of certificates	84
Introducing flexibility in fulfilling obligation	85
7. Interactions with other domestic and international policy	87
Claiming support for SAF across multiple schemes	87
Tankering	88
8. Enforcement	90
Revocation of certificates	90
Civil penalties	91

Public sector equality duty	93
What will happen next	94
Glossary	95
Annex A: Summary of consultation questions	96

Ministerial foreword: Baroness Vere of Norbiton

After some of the toughest years in the 100-year history of aviation, the sector is continuing to make strong progress towards recovery. Airports are bringing forward new investment and infrastructure plans, flights are getting fuller, and an improving passenger experience will help turn recovery into renewal. Now, more than ever, the sector is recognising that sustainability has to be at the core of its business, as it begins to transform for a net zero world. Progress on decarbonising is continuing at pace with aviation sector emissions expected to have peaked in 2019.

Less than a year ago, we launched the Jet Zero Strategy, setting out how we will deliver on our commitment to reach net zero aviation in the UK by 2050. Sustainable aviation fuel (SAF) is one of six key measures in the Jet Zero Strategy, and we're nurturing its growth. Last year 26 million litres of SAF was supplied in the UK¹ and we have seen ground-breaking progress with the RAF flying the first wide bodied plane in the world on 100 per cent SAF, and Virgin Atlantic winning £1 million of government funding to operate the first net zero transatlantic flight, running on 100% SAF, by the end of 2023.

Our vision is for the UK to be a global leader in the development, production and use of SAF, allowing us to grow the sector sustainably and achieve net zero flying. Building domestic SAF production capacity represents not only a significant economic opportunity but also a means for strengthening our energy security.

To drive decarbonisation within the UK's aviation sector and the growth of SAF in the UK, we confirmed in July 2022 that we would introduce a SAF mandate in 2025 requiring at least 10% of jet fuel to be made from sustainable feedstocks by 2030. By mandating the use of SAF, we are not only driving carbon savings but creating a UK market for SAF. The scheme will provide an incentive and price support for SAF producers and signal to investors the vital role SAF will play in the UK.

This document builds on the commitments made last year by setting out a long-term trajectory for the mandate, proposing the level of incentive for supplying SAF, signalling how

¹ RTFO 2022 provisional statistical release <https://www.gov.uk/government/collections/renewable-fuel-statistics>

we will encourage the development of more advanced production pathways and providing industry with clarity with proposals on administering and complying with the mandate.

In addition to securing demand for SAF through the mandate we are:

- **kick starting a domestic SAF industry.** We have already invested in early-stage development of eight UK SAF plants through the Green Fuels, Green Skies competition. We have recently announced that five projects will receive a share of the £165m Advanced Fuels Fund, which aims to take as many as possible through to commercial-scale production. This will drive our **ambition to see at least five commercial-scale SAF plants under construction in the UK by 2025**. Today we have launched the second application window for the [Advanced Fuels Fund](#).
- **working in partnership with industry and investors to build long term supply.** We have been actively looking at how to create the long-term conditions for investable projects in the UK and engaged extensively with industry last year on the key challenges in the UK to investment in SAF. We commissioned an independent review from Philip New in October 2022 into how to accelerate investment in a UK SAF industry. The government welcomes Philip New's report and will respond to it very shortly. The government has been clear that it wants to see the UK continue to capture its share of the global SAF market and play a leading role in the development, production and use of SAF. As our response to Phil New's independent report will set out, we will continue to work in partnership with industry and investors to explore the best approach to addressing barriers to investment.

We are now at a pivotal moment. Through this consultation process, and our partnership with industry, including through the Jet Zero Council, I am confident we can deliver our vision for global leadership in SAF and achieve net zero aviation. This is a model that could be adopted around the world. Now that the International Civil Aviation Organization (ICAO) has also committed to a goal of net zero CO₂ emissions from international aviation by 2050, I want to see a stretching target for global SAF uptake with the right measures to make that happen. I am proud that the UK is making a world leading contribution.

Executive summary

Context

Jet Zero

The 2021 Net Zero Strategy set the country on an ambitious path to net zero by 2050. As the largest greenhouse gas (GHG) emitting sector, transport needs to be decarbonised as a priority. The UK has demonstrated its ambition to be a global leader in decarbonising aviation by committing to net zero aviation by 2050. SAF is one of the key levers available to government and industry to accelerate the transition to net zero aviation.

Our 2022 *Jet Zero Strategy* set out our plan for achieving net zero aviation or “jet zero” by 2050, through rapid technology development, with ambitious targets to achieve net zero domestic aviation and zero emission airport operations in England by 2040. We have also played a leading role in securing agreement for the International Civil Aviation Organization to adopt net zero by 2050.

Decarbonising aviation will be a challenge. In the Jet Zero Strategy, the government stated that it would focus its policies across six measures: system efficiencies; sustainable aviation fuels; zero emission flight; markets and removals; influencing consumers and addressing non-CO₂ impacts.

The “High ambition” pathway in the Jet Zero Strategy assumes 50% SAF uptake by 2050 - delivering 9 MtCO₂e savings. This is alongside savings from system efficiency improvements (8 MtCO₂e), entry of zero emission aircraft into commercial service (2 MtCO₂e), and carbon pricing (14 MtCO₂e). This pathway results in 19 MtCO₂e residual emissions in 2050 to be addressed by greenhouse gas removal technologies, and nearly a 50% reduction in UK aviation CO₂ emissions compared to 2019 levels.

As part of our forthcoming Low Carbon Fuels strategy, we will be looking at deployment of low carbon fuels across all transport modes and how they are best deployed up to 2050. This will include the role SAF has to play and how we can continue to work closely with industry on providing the conditions required for a sustainable long-term low carbon fuels and SAF industry in the UK, including stabilising the market for feedstocks and providing certainty to investors.

Sustainable aviation fuel

Sustainable aviation fuel, made from low carbon feedstocks, can be easily blended with conventional jet fuel. It can achieve lifecycle emission savings of over 70% when fully replacing fossil derived kerosene and can be used in existing aircraft, engines, and infrastructure without modification.

Not only that, but SAF delivers wider benefits, particularly when produced in the UK, by providing fuel security, potentially supporting up to 5,200 UK jobs by 2035 and a further 13,600 through global exports, and supporting economic growth (up to £742m annually by 2035)².

SAF production is currently very limited, although volumes are increasing, with provisional statistics showing that 26 million litres were supplied in the UK in 2022. We need to continue to rapidly increase supply and it is clear that the government must help drive the demand for, and production of, these fuels.

SAF can be made from a variety of feedstocks including municipal solid waste, recycled carbon fuels (RCFs) (making use of unrecyclable plastic and waste industrial gases) and in time, from harnessing the energy in low carbon electricity to produce a synthetic fuel (i.e. a power to liquid fuel). The government has committed that it will only provide incentives for SAF made from wastes, residues or low carbon energy. This ensures that the risks of using crop-based feedstocks which could result in deforestation and competition with food are avoided.

The government has set out its vision to establish the UK as a global leader in the development, production and use of SAF. The government's SAF programme has three pillars: creating secure and growing UK SAF demand; kickstarting a domestic SAF industry; and working in partnership with industry and investors to build long term supply.

A mandate to create demand for SAF and drive GHG savings

The government recognises the need to create certainty for industry. We have provided support for advanced fuels through the Renewable Transport Fuel Obligation (RTFO) since 2018 under the 'development fuel' sub-target. This has enabled early SAF suppliers to claim support in the form of tradeable certificates. However, without mandated amounts of SAF, and with the maximum incentive set in relation to road fuel rather than aviation fuel costs, this only promoted production and use of small volumes of SAF in the UK.

This is why the government has committed to introducing a bespoke SAF mandate, giving a guaranteed level of demand as well as the strongest signal to investors on the vital role the government believes the technology will play in the UK. The mandate will create a long-term requirement to supply SAF and will provide an incentive to SAF suppliers (in the form of tradeable certificates which will have a cash value). The value of these certificates will be determined by the market, and it is our intention that they close the gap between the price of kerosene and the cost of SAF, so providing a level of price support for the SAF industry.

The mandate will incentivise higher GHG savings by providing greater support for SAF with higher GHG savings (in the form of additional certificates).

² [Sustainable Aviation Fuel Report_20200231.pdf](#)

We have already consulted on the broad principles and targets for the mandate. We now need input from stakeholders through this consultation to finalise the design of the scheme and ensure we have legislation in place for the mandate to begin in 2025.

The SAF mandate in the context of other policies

The SAF mandate will build on the progress made by the RTFO. The RTFO is the government's flagship transport decarbonisation policy and is responsible for delivering one third of the transport sector's contribution to current carbon budget savings, making up 7% of road fuel in 2022 and could support more than 10,000 direct and indirect jobs.

Once the SAF mandate is up and running, SAF will no longer be eligible for incentives under the RTFO.

In the aviation policy sphere, the SAF mandate will sit alongside the UK Emissions Trading Scheme (UK ETS). Where use of SAF is reported on UK ETS routes, it is zero rated and aircraft operators can claim a corresponding reduction in their UK ETS obligations. This is intended to help bridge the cost differential between SAF and conventional aviation fuel as the industry develops. In 2022 the UK ETS Authority sought views on how GHG emissions from SAF can be accounted for appropriately in the UK ETS, and how UK ETS should interact with the future SAF mandate. A government response to the consultation will be published later this year.

2021 SAF mandate consultation

In our 2021 consultation on the SAF mandate we sought views on:

- the need for a SAF mandate;
- the level of ambition;
- fuel and feedstock eligibility;
- sustainability criteria;
- interactions between the SAF mandate and other domestic and international policy; and
- compliance, reporting and verification principles that will steer the creation of the scheme.

In July 2022, in response to the consultation, we confirmed that we will introduce a SAF mandate from 2025 and that by 2030 at least 10% of jet fuel should be made from sustainable feedstocks. We also committed that:

- it will be a GHG emissions scheme to promote the fuels with the highest GHG savings;
- SAF will be awarded with tradeable certificates for cost-effective compliance;
- the obligation to supply SAF will be placed on aviation fuel suppliers;
- it will be a separate scheme from the RTFO and SAF will no longer be eligible for incentives under the RTFO once the SAF mandate commences;
- SAF must be made from wastes or residues (biomass, RCFs) or low carbon electricity (renewable or nuclear). Crop based biofuels will not be permitted;
- SAF must meet strict sustainability requirements;
- we will promote power to liquid fuels (PtL) via a sub-target to drive its production (from here on referred to as a PtL mandate); and

- fuel made from hydroprocessed esters and fatty acids (HEFA) will be capped to avoid diverting feedstocks from road transport where they are still needed during the transition to zero emission road vehicles.

Summary of consultation content and proposals

This second consultation on the SAF mandate seeks stakeholder views on the detailed design of the mandate. This includes:

- the trajectory to 2030 and beyond, the PtL mandate and the level of the HEFA cap;
- how the scheme provides price support;
- the level of the buy-out price – which determines the maximum potential incentive for supplying SAF and helps drive price support for SAF;
- eligible fuels and sustainability criteria;
- the design of the certificate system including how certificates will be issued, traded and used for compliance;
- the Administrator of the scheme and enforcement;
- who the obligation applies to and how it is discharged; and
- interactions with other domestic and international policy.

These proposals have been developed using a wide range of qualitative and quantitative evidence. Stakeholders have been an essential part of the development process, and views on the emerging proposals have been gathered through the Jet Zero Council SAF Delivery Group subgroups and the DfT's Low Carbon Fuels Quarterly Stakeholder Workshops.

This consultation will be open for 12 weeks to allow time for stakeholders to provide detailed feedback on the proposals put forward. The aim of this consultation is to gather sufficient evidence to confirm the final policy design of the mandate so that the final legislation can be prepared in time for 2025.

Targets and incentive levels

We need to set targets for the proportion of SAF we want to achieve in the UK fuel mix. We are proposing to set targets that increase from 2025 to 2040, providing 15 years of certainty for the industry. Uncertainties in technology development and feedstock supply become too great after 2040 to set specific targets, however we do show how the trajectories we present fit with the scenarios and ambition to 2050 set out in the Jet Zero Strategy, and how they ultimately could get us to net zero. The targets will be regularly reviewed, with both the Jet Zero Strategy and the SAF mandate being subject to review at least every 5 years.

We want to be ambitious in driving demand for SAF, but we have to balance this with the potential availability of, and competition across and within sectors for, sustainable feedstocks that can be used for SAF. To ensure we have a resilient SAF supply system, the UK should have the right balance of domestic production, imports and exports. Therefore, the SAF mandate will not differentiate between SAF made in the UK and that made overseas. All trajectories set out in this consultation assume that the mandated UK SAF mix will be made from a combination of domestically produced and imported SAF.

There are large uncertainties on feedstock availability and how much will be available to UK aviation. Given this uncertainty, we are consulting based on the use of feedstock availability ranges. We will update our modelling based on the findings from the Low Carbon Fuels and Biomass strategies before we publish a government response to this consultation.

We are conscious that these are important decisions, and we must get them right. We want to show sufficient ambition so that we drive investment in SAF and are not left behind by international competitors. However, if we are too ambitious and set targets that cannot be met, we risk creating a costly policy that does not deliver the GHG reductions it aimed for. We also risk undermining the industry should the ambitious targets need to be reduced in the future. These will be critical considerations in reviewing the evidence and taking final decisions on targets.

It is also important to note other aspects of the SAF mandate, in particular, the levels of both the HEFA cap and the buy-out price, will interact with the overall targets. We therefore need to ensure that these policy levers work effectively together to deliver the GHG emission reductions we need.

PtL mandate

It is important we support a wide portfolio of SAF technologies. A significant proportion of SAF made directly from low carbon power generation could be needed to get aviation to net zero, particularly from the mid-2030s, but given its additional cost relative to other SAF technologies it will need more support to get to market. We are therefore proposing an additional mandate to supply PtL fuels.

PtL fuels do not rely on biomass or other feedstocks that may have limited availability or come with risks of wider environmental damage. Although PtL fuels do not rely on feedstocks, they do require a lot of energy, both for production of hydrogen, and in some cases, for the capture of carbon. Because of this, PtL is currently one of the most expensive SAF production methods and its impacts on future UK energy requirements require consideration.

As with the main mandate target, it is therefore important that we set realistic targets that take into account potential supply both of the available final fuel but also energy demands and availability of low carbon hydrogen. We also need to factor in the additional costs of supplying these fuels including for the airline passenger.

HEFA cap

Most SAF being produced today is HEFA – hydroprocessed esters and fatty acids - which requires oily feedstocks. Because the UK is committed to using only wastes, HEFA for low carbon fuels used in the UK is derived from used cooking oil or tallow. However, in other parts of the world, HEFA is made from crops such as oilseed rape or palm. HEFA is currently the lowest cost SAF because it is being produced in large scale production facilities.

The UK currently uses feedstocks suitable for HEFA, namely waste oils and fats, to produce biodiesel for use in road and non-road vehicles, where it delivers, on average, an 87.7% GHG saving relative to fossil fuels. In 2021 this was equivalent to diesel cars on the road emitting 128 fewer megatons of carbon dioxide than if they had used fossil diesel. Even allowing for biodiesel use reducing as road vehicles increasingly electrify, there is not

sufficient availability of waste-derived HEFA feedstocks for the SAF contribution to net zero aviation to be delivered through this technology alone. This makes it essential that we leave space for newer technologies, which are currently more expensive but use a wider range of feedstocks.

We are therefore proposing to cap the amount of HEFA that can contribute to the SAF mandate and have set out a range within which the HEFA cap could fall. We welcome evidence to support decisions on where to set the HEFA cap.

Buy-out price and its role in providing price support

The purpose of a buy-out mechanism is to provide a way for suppliers to discharge their mandate obligation in cases where they are unable to secure a supply of SAF, and to ensure that disproportionately high costs are not passed on to consumers in the case where the additional costs of supplying SAF are unacceptably high. It also effectively sets the maximum price for mandate certificates, and therefore the maximum incentive that will be available for supplying SAF under the mandate.

It is intended that under normal market conditions obligated parties would supply SAF rather than use the buy-out mechanism – that is, it is cheaper for them to supply SAF (or purchase certificates from others who have supplied SAF) than to discharge their obligation through the buy-out. In line with the way the RTFO operates, we anticipate that financial support for SAF flows up the supply chain to the SAF producer.

We therefore intend to set a buy-out price that will: ensure GHG savings and support the SAF industry by encouraging the supply of SAF over the use of the buy-out; and provide a crucial level of price support by future-proofing against price fluctuations in the fuels market whilst preventing extremely high costs from being passed onto consumers. We have set out a range of options.

Eligible fuels and sustainability criteria

The government is clear that the SAF mandate must deliver fuels with the highest sustainability credentials. Further to the commitments made in the government response to the first consultation, we propose that:

- SAF must have a carbon intensity reduction of at least 40% relative to fossil kerosene;
- The GHG emission calculation methodologies currently used in the RTFO will be adopted in the mandate to determine carbon intensity, with a combination of default and actual values permitted;
- Where hydrogen is used as a feedstock it must be low carbon, where low carbon is defined as nuclear and electrolytic hydrogen, biohydrogen derived from wastes or residues and RCF hydrogen;
- In line with the RTFO, sustainability data will need to be independently verified;
- Low carbon hydrogen, ammonia, and unleaded aviation gasoline (avgas) supplied for UK aviation will be eligible for certificates, but fossil equivalents will not be subject to an obligation (as an obligation may be overly burdensome on suppliers due to early stage markets for low carbon alternatives of these fuels).

To further encourage the use of the most sustainable fuels, we are proposing to increase the minimum GHG savings threshold over time. This will help facilitate the future integration of CCS into SAF production, ensuring the GHG savings are maximised and the best use of biomass is supported.

The Administrator of the scheme and enforcement

We propose that the Administrator of the SAF mandate will be the Secretary of State for Transport, and that the day-to-day duties will be carried out by an administrative unit within the Department for Transport, in line with current practice under the RTFO.

Should an obligated supplier or an account holder applying for certificates fail to meet certain criteria, it will be necessary for the Administrator to impose civil penalties as an act of enforcement. For each penalty that involves gaining certificates, we propose that the penalty should be in proportion to the buy-out price for the number of certificates gained. For any other penalty, we propose that a fee of £65,000 will be charged, which has been benchmarked against other similar policies.

Who the obligation applies to and how it is discharged

As confirmed in the government response to the previous consultation, suppliers of obligated fuel to the UK aviation market will be subject to two obligations – a standard obligation to supply SAF (excluding PtL) and an additional obligation to supply PtL fuels.

Certificates will be awarded for the supply of SAF, with additional certificates rewarded to fuels with better GHG savings. These can be traded between obligated parties so that those who oversupply can sell them to those that need them.

In line with how the RTFO works, we propose that obligated parties will discharge their obligations by redeeming certificates at the end of the obligation period or by paying to buy out of their obligations (or a combination of the two).

Interactions with other domestic and international policy

Our first consultation focused on potential interactions between the mandate and specific domestic and international policies such as the UK ETS and CORSIA. For the purposes of setting the mandate out in legislation and for future-proofing the scheme, it is important that we set out an approach that will cover interactions with current and future schemes. For this reason, we propose that as far as possible the SAF mandate should align with multiple incentive rules set out in the RTFO. The RTFO approach has worked well in practice since 2011 for road fuel and similarly for the small volumes of SAF that have been claimed under the RTFO since its inclusion in 2018.

In response to the mandate, airlines may opt to take on additional fuel for inbound trips to avoid having to refuel in the UK - this is known as 'tankering' which can result in carbon leakage. A potential mitigation approach would be to implement a requirement on airlines to uplift a minimum amount of fuel when departing a UK airport. However, it is difficult to determine the extent of potential tankering behaviour given that a preferred position on trajectories has not been determined. We therefore welcome views and supporting analysis

on whether the extent of tankering as a result of the SAF mandate justifies the introduction of a minimum uplift requirement.

Next steps

These proposals are set to make a step change in the uptake and use of SAF which will be an essential part of our toolkit to meet our Jet Zero strategy commitments.

There are a number of detailed proposals in this consultation, and the evidence we collect will be vitally important in helping us set our targets at the right level to show ambition, deliver GHG savings, and drive investment whilst factoring in the considerable uncertainty in feedstock availability. Hand in hand with this is setting the level of the buy-out price at the right level to drive sufficient price support for SAF supply. We want to deliver an effective SAF incentive scheme that complements our parallel work to continue to drive UK SAF plant construction through our grant funding competitions, and work with industry and investors to explore the best approach to addressing barriers to investment, including consideration of how to stabilise the feedstock market in the UK and address revenue certainty.

There will be opportunities to discuss the content of this document and your views with the team, through Jet Zero Council delivery and sub-group meetings and our regular stakeholder workshops.

We look forward to receiving your responses to these proposals.

How to respond

The consultation period began on 30 March 2023 and will run until 22 June 2023. Please ensure that your response reaches us before the closing date. If you would like further copies of this consultation document, it can be found at <https://www.gov.uk/dft#consultations> or you can contact LowCarbonFuel.Consultation@dft.gov.uk if you need alternative formats (Braille, audio CD, etc.).

Our preferred method of receiving responses is via email. If you are unable to respond through the online by email, we would invite you to please let us know by asking someone to email on your behalf. If none of the above is possible, then we invite you to provide responses to:

SAF Mandate Team, Low Carbon Fuels

Great Minster House

33 Horseferry Road

London

SW1P 4DR

When responding, please state whether you are responding as an individual or representing the views of an organisation. If responding on behalf of a larger organisation, please make it clear who the organisation represents and, where applicable, how the views of members were assembled.

We will be hosting consultation events throughout the consultation period. If you would be interested in attending these events, please contact LowCarbonFuel.Consultation@dft.gov.uk.

Freedom of Information

Information provided in response to this consultation, including personal information, may be subject to publication or disclosure in accordance with the Freedom of Information Act 2000 (FOIA) or the Environmental Information Regulations 2004.

If you want information that you provide to be treated as confidential, please be aware that, under the FOIA, there is a statutory Code of Practice with which public authorities must comply and which deals, amongst other things, with obligations of confidence.

In view of this it would be helpful if you could explain to us why you regard the information you have provided as confidential. If we receive a request for disclosure of the information, we will take full account of your explanation, but we cannot give an assurance that confidentiality can be maintained in all circumstances. An automatic confidentiality disclaimer generated by your IT system will not, of itself, be regarded as binding on the Department for Transport (DfT).

DfT will process your personal data in accordance with the Data Protection Act (DPA) and in the majority of circumstances this will mean that your personal data will not be disclosed to third parties.

Confidentiality and data protection

This consultation is carried out by the Department for Transport, working with other government departments, including the Department for Energy Security and Net Zero (DESNZ), Department for Business and Trade (DBT) and Department for Environment, Food and Rural Affairs (DEFRA), on creating a mandate for SAF.

In this consultation we are asking for:

- your name and email, in case we need to ask you follow-up questions about your responses (you do not have to give us this personal information, but if you do provide it, we will use it only for the purpose of asking follow-up questions)

If an organisation we are additionally asking for your organisation's:

- name, for identification

Your consultation response and the processing of personal data that it entails is necessary for the exercise of our functions as a government department. DfT will, under data protection law, be the controller for this information. [DfT's privacy policy](#) has more information about your rights in relation to your personal data, how to complain and how to contact the Data Protection Officer.

As sustainable aviation fuels policy has many interactions with other government policy and work, to ensure we develop effective policy, we may share your responses with other government departments, such as DESNZ, DBT and DEFRA. We will remove your personal details before we share your response with other government departments.

We will not use your name or other personal details that could identify you when we report the results of the consultation. Any information you provide will be kept securely and destroyed within 12 months of the closing date. Any information provided through the online questionnaire will be moved to our internal systems within two months of the consultation period end date.

1. Introduction

The role of SAF in achieving net zero aviation

Historically, aviation GHG emissions have been challenging to address due to the long lead times of aviation equipment and infrastructure and the relatively early stage of sustainable technology development. This has led to aviation emissions more than doubling between 1990 and 2019 against a 240% increase in passenger demand. Following this trend, the aviation sector is projected to be one of the UK's largest contributors to GHG emissions by 2050. In response, the UK has demonstrated its ambition to be a global leader in decarbonising aviation by committing to net zero aviation by 2050, as set out in the Transport Decarbonisation Plan³.

The Jet Zero Strategy⁴, published in July 2022, is the strategic framework that will guide our approach to net zero aviation, and our five-year delivery plan policies and regular reviews of the Strategy will ensure we are on the right path to meet our commitment. The Strategy recognises the instrumental role that SAF will play as one of the key technologies in achieving aviation decarbonisation targets.

The upcoming Low Carbon Fuels Strategy will set out how the deployment of low carbon fuels may evolve across different transport modes in the period to 2050. As such, it will help address the challenges and risks associated with the transition from low carbon fuels being predominantly deployed in road transport to their use in harder to decarbonise modes such as aviation. The strategy will explain the principles that inform current and future policy decisions and will outline the government's strategic approach to maximising the benefits of low carbon fuel adoption and deployment. The SAF mandate is one of the key government measures that will shape low carbon fuels policy in the period up to 2050.

SAF is a drop-in fuel, meaning it can be blended into traditional fossil-based aviation fuel and used in existing aircraft, engines and infrastructure without modification. These advanced fuels, obtained from sustainable feedstocks, can achieve lifecycle emissions savings of over 70% compared with conventional jet fuel.

SAF may have the potential to reduce non-CO₂ impacts of aeroplanes, including contrails, by reducing particulate emissions. There are significant uncertainties around the magnitude

³ <https://www.gov.uk/government/publications/transport-decarbonisation-plan>

⁴ <https://www.gov.uk/government/publications/jet-zero-strategy-delivering-net-zero-aviation-by-2050>

of non-CO₂ impacts on climate; however, studies indicate that non-CO₂ emissions account for over half of climate impacts from aviation.

Overview of SAF technologies

SAF can be derived from a wide range of sources, which achieve carbon savings relative to fossil fuel in different ways:

- Where biomass is used to produce biofuels, carbon absorbed from the atmosphere during the lifecycle of the biomass is equal to that emitted upon fuel combustion. This achieves emissions savings compared to fossil fuel which permanently release carbon into the atmosphere that was otherwise locked in the ground;
- Where fossil wastes are used to produce RCFs, such as municipal solid waste or industrial waste gases, carbon savings are achieved when it is more efficient to process these into fuels instead of disposing them via conventional means including power to energy; and
- Where hydrogen is combined with non-biomass CO₂ using renewable or nuclear power to produce power-to-liquid fuels (PtL), emissions savings are achieved through utilising carbon that would otherwise be emitted to, or is already in, the atmosphere.

The production technology employed is dependent on the feedstock used and therefore the chemical conversion process required to synthesise kerosene. There are nine approved pathways to produce SAF, which are variations of the four key technologies utilised:

- Hydroprocessing of waste oils or fats (known as hydroprocessed esters and fatty acids or HEFA);
- Alcohol to jet (AtJ) which converts alcohols into SAF by removing oxygen;
- Gasification and Fischer-Tropsch (Gas + FT) which breaks down biogenic and non-biogenic waste into a gas form which is then converted into kerosene; and
- Power-to-liquid (PtL) which combines hydrogen and CO₂ derived from a point source or captured from the air using non-biomass electricity

Potential for SAF to deliver green jobs and growth

In addition to the environmental benefits, a domestic SAF industry could provide opportunity to strengthen fuel security as well as deliver significant economic gains to the UK, export potential from UK derived intellectual property and create thousands of green jobs. Many SAF production plants are planned in areas in need of regeneration, supporting the levelling up agenda (up to 5,200 UK jobs by 2035 and a further 13,600 through global exports) and helping existing industry in need of sustainable transition.

The UK is well placed to develop a UK SAF industry due to several competitive strengths in aviation technology and fuels infrastructure and potential strengths in feedstock access and green finance capacity. Further strengths are the UK's technical expertise and leadership in development of hydrogen and carbon capture, utilisation and storage (CCUS) industries.

Whilst we are pleased to see that SAF is starting to be supplied and produced in the UK thanks to the support of the RTFO, production and use of SAF in the UK still remains limited. Several challenges facing the emerging industry must be overcome to help increase the adoption and production of SAF. Many SAF production pathways are yet to be proven at scale, leading to high initial capital and operating costs and uncertainty on return on investment. A long-term regulatory and policy framework is required to support industry and help overcome the key barriers to investment - namely technology, construction, feedstock and revenue certainty - so that SAF projects are an investable proposition for SAF developers and investors. The cost of SAF will continue to remain significantly higher than that of fossil kerosene without further intervention.

Beyond this, the finite amount of feedstock, in combination with an increasing international interest in SAF, results in competing global demand for sustainable wastes and residues. Investors need secure, long-term feedstock contracts and off-taking agreements in place to support UK investments.

The UK's SAF strategy

The UK Government recognises that policy interventions are necessary if our ambition to be a global leader in SAF is to be realised. That is why we are taking bold action to support industry in addressing these issues by:

- **Creating secure and growing UK SAF demand.** We are introducing a SAF mandate from 2025, requiring at least 10% (around 1.5 billion litres) of UK aviation fuel to be made from sustainable sources from 2030. This consultation sets out our final policy proposals.
- **Kickstarting a domestic SAF industry.** We have already invested in early-stage development of eight UK SAF plants through the Green Fuels, Green Skies competition. We have recently announced that five projects will receive a share of the £165m Advanced Fuels Fund, which aims to take as many as possible through to commercial-scale production. This will drive our ambition to see at least five commercial-scale SAF plants under construction in the UK by 2025. Today we have launched the second application window for the [Advanced Fuels Fund](#). To accelerate novel SAF production pathways to market, we are also setting up a UK Clearing House to support testing and certification.
- **Working in partnership with industry and investors to build long term supply.** We have been actively looking at how to create the long-term conditions for investable projects in the UK and engaged extensively with industry last year on the key challenges in the UK to investment in SAF. This culminated in us commissioning an independent review from Philip New in October 2022 into how to accelerate investment in a UK SAF industry. The government welcomes Philip New's report and will respond to it very shortly.

The purpose of a SAF mandate

Since 2018, SAF supply has been rewarded through the RTFO⁵ – the flagship policy that delivers one third of transport's contribution to carbon budget savings by increasing the

⁵ S.I. 2007/3072 as amended by S.I. 2009/843, 2011/2937, 2013/816, 2015/534, 2020/1541 and 2021/1420.

supply of low carbon fuels. The RTFO has resulted in renewable fuel accounting for seven per cent of the market, with 2.8 billion litres supplied in the first nine months of 2022, and supports 10,000 direct and indirect jobs.

Building on this success, the mandate will replace the RTFO as the operational support mechanism for SAF from 2025. A bespoke policy will allow specific SAF targets to be set, ensure the mechanism to be tailored to SAF needs and better adhere to the polluter pays principle. By mandating the use of SAF, we seek to generate demand for SAF and create certainty for investors through the long-term targets. The mandate will also provide an incentive to SAF producers in the form of a tradable certificate, which will close the price gap between fossil kerosene and SAF. SAF with greater GHG savings will receive greater support, thereby incentivising the most sustainable fuels to be used and driving carbon savings.

In combination with policy interventions focused on domestic SAF production, the mandate will help the UK achieve its commitment of having five commercial SAF plants under construction by 2025.

The SAF mandate has been designed to complement domestic and international aviation decarbonisation policy and existing international commitments to aviation decarbonisation. Namely, the UK ETS, and Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA).

Previous consultation and aim of this consultation

The government first consulted on the [introduction of a SAF mandate](#) in July 2021, seeking views across the high-level mechanisms of the mandate. In July 2022, we published a [government response to the consultation](#) which confirmed the introduction of a SAF mandate⁶. The document contained firm commitments on a number of key proposals, setting out the direction we are taking to secure demand in the UK through a SAF mandate, including:

- from 2025, the SAF mandate will apply and will be equivalent to at least 10% (around 1.5 billion litres) of jet fuel to be made from sustainable feedstocks by 2030;
- the mandate will operate as a GHG scheme with tradeable certificates to incentivise use of the most sustainable fuels;
- the mandate will apply to jet fuel suppliers and will begin in 2025, outside of the RTFO;
- eligible fuels will be waste and residue-derived biofuels, RCFs and PtL fuels;
- SAF must meet strict sustainability criteria including making at least 50% GHG savings relative to fossil jet fuel; and
- SAF derived from HEFA will be capped and a PtL obligation will be introduced to encourage the development of strategically important SAF pathways.

Following on from these commitments, we have been able to design the detailed aspects of how the mandate will operate by continuing regular engagement with stakeholders through the Jet Zero Council SAF Delivery Group. This consultation seeks comment on those

⁶ For the remainder of this document, where we state that “we previously confirmed” it should be taken that these commitments were made in the government response published in July 2022, unless otherwise stated.

processes, in particular the long-term trajectory, design of the certificate system, practicalities of administering and complying with the mandate and interactions with other domestic and international policy. Throughout this consultation we have set out a preferred position based on available evidence. However, in the cases where we are not in a position to put forward a preferred option, we are requesting further evidence from stakeholders.

The aim of this consultation is to gather sufficient evidence to confirm the final policy design of the mandate. Following the closure of the consultation window, we will review the responses with the aim of making firm commitments on all elements of the SAF mandate in a government response to the consultation later this year. We will then proceed with the legislative process to implement the mandate by 2025. Concurrently, officials will develop comprehensive guidance for suppliers and other parties involved in the operation of the mandate.

SAF mandate legislation

The mandate will be implemented as an affirmative statutory instrument using the powers granted by the Energy Act 2004 – the same primary legislation that allows the RTFO to prescribe an obligation on fuel suppliers.

The Energy Act currently includes powers to include support for SAF derived from biomass (wastes or residues) and PtL using renewable energy. Supporting fuels produced from fossil wastes (recycled carbon fuels) and those produced from nuclear energy required a broadening the primary powers underpinning the RTFO and SAF mandate. To secure these, we tabled a government amendment to the Energy Bill on 9 March 2023. This amends the Energy Act to allow both RCFs and nuclear derived fuels to be supported under renewable transport fuel orders. Subject to the Bill completing the legislative process through parliament, we expect the Bill to receive Royal Assent later this parliamentary session.

Timeline

The timeline of the work to date and next steps is provided below:

- November 2020: Ten Point Plan announced the intention to consult on a SAF mandate
- 23 July 2021 – 19 September 2021: First SAF mandate consultation open for responses
- 19 July 2022: Government response to the first SAF mandate consultation published
- **30 March 2023 – 22 June 2023: Second SAF mandate consultation open for responses**
- By end 2023: Government response to the second SAF mandate consultation published confirming the final policy design of the SAF mandate
- 2024: DfT begins legislative process. DfT publishes detailed guidance for parties involved in the SAF mandate
- 1 January 2025: UK SAF mandate commences

2. Targets and price support for SAF

In our first mandate consultation we set out high-level scenarios for SAF uptake under the mandate over the short and long-term, based on early modelling of the SAF market. We set out five potential target trajectories which all started at 0.5% in 2025 and ranged from around 3% to 10% in 2030, and from 15% to 75% in 2050. The option preferred by respondents was Scenario E ('Early SAF breakthrough'), which had a target of 10% in 2030 and 75% in 2050. In the government response we confirmed our target of at least 10% SAF in the UK jet fuel mix by 2030, which correlated with our highest ambition scenario in our early modelling, as well as with the Jet Zero Strategy high ambition scenario.

The mandate consultation government response confirmed our 2030 uptake target, but not the targets from 2025 to 2030 or from 2030 onwards. It is important that we set these targets carefully to ensure the balance is right between ambition and deliverability.

We want to show strong ambition and demonstrate to industry and investors the important role we see SAF playing in aviation decarbonisation. On the other hand, we need to set targets which are achievable within the bounds of SAF, feedstock, low carbon electricity, and hydrogen availability both domestically and worldwide. If targets are set at a level which is unachievable, we could see high levels of buy-out from the scheme, resulting in costs to industry and consumers with none of the GHG emissions benefits.

Updated analysis to inform targets

Since the government response to the SAF mandate consultation has been published, we have conducted significant additional analysis to strengthen our evidence base. This has allowed us to set out potential targets from 2025 to 2030 and 2030 and beyond. Our additional analysis has focused particularly on the underpinning assumptions on:

- potential costs of SAF production;
- GHG emissions savings;
- energy requirements; and
- feedstock availability.

This analysis is informed mainly by the Aviation Impact Accelerator (AIA), led by Cambridge University's Whittle Laboratory; the Jet Zero Strategy; research by NNFCC and Ricardo and E4Tech; as well as preparatory work for the Low Carbon Fuels and Biomass strategies, which are still currently under development.

Data uncertainty

Due to the significant uncertainty relating to data on the SAF market, particularly post 2030, parts of our analysis rely on the use of ranges rather than central figures (see cost-benefit

analysis for more information). This relates in particular to our assumptions on feedstock availability, demand and competition across sectors, as the current available data is highly uncertain and in some cases contradictory (see figure 1 below). We have drawn on data from the AIA as well as research conducted by Ricardo and E4Tech for the Low Carbon Fuels and Biomass strategies to settle on the upper and lower bounds of our data range for feedstock availability available to aviation. The upper bound is taken from the AIA model, and the lower bound from the Ricardo and E4Tech Biomass Strategy model. By taking this approach we can represent the best- and worst-case scenarios for UK aviation’s share of global feedstock availability and ensure that the full range of uncertainty is modelled. The use of ranges and the inherent uncertainty in this means that in certain cases we have not yet been in a position to set out our preferred policy option, in particular on targets and trajectories, a HEFA cap and a PtL mandate.

We will update our modelling based on the findings from the Low Carbon Fuels and Biomass strategies before we publish a government response to this consultation. This should provide us with more certainty on feedstock availability to bolster our target trajectory options and therefore allow us to more clearly set out potential impacts of the mandate, such as projected potential ticket price impacts and GHG emissions savings. Following the updating of our modelling, we will informally engage with stakeholders to share the results. Should the findings change the trajectory options set out in this consultation significantly, we will ensure stakeholders have been consulted appropriately before making a final decision, using a further short, targeted consultation if necessary.

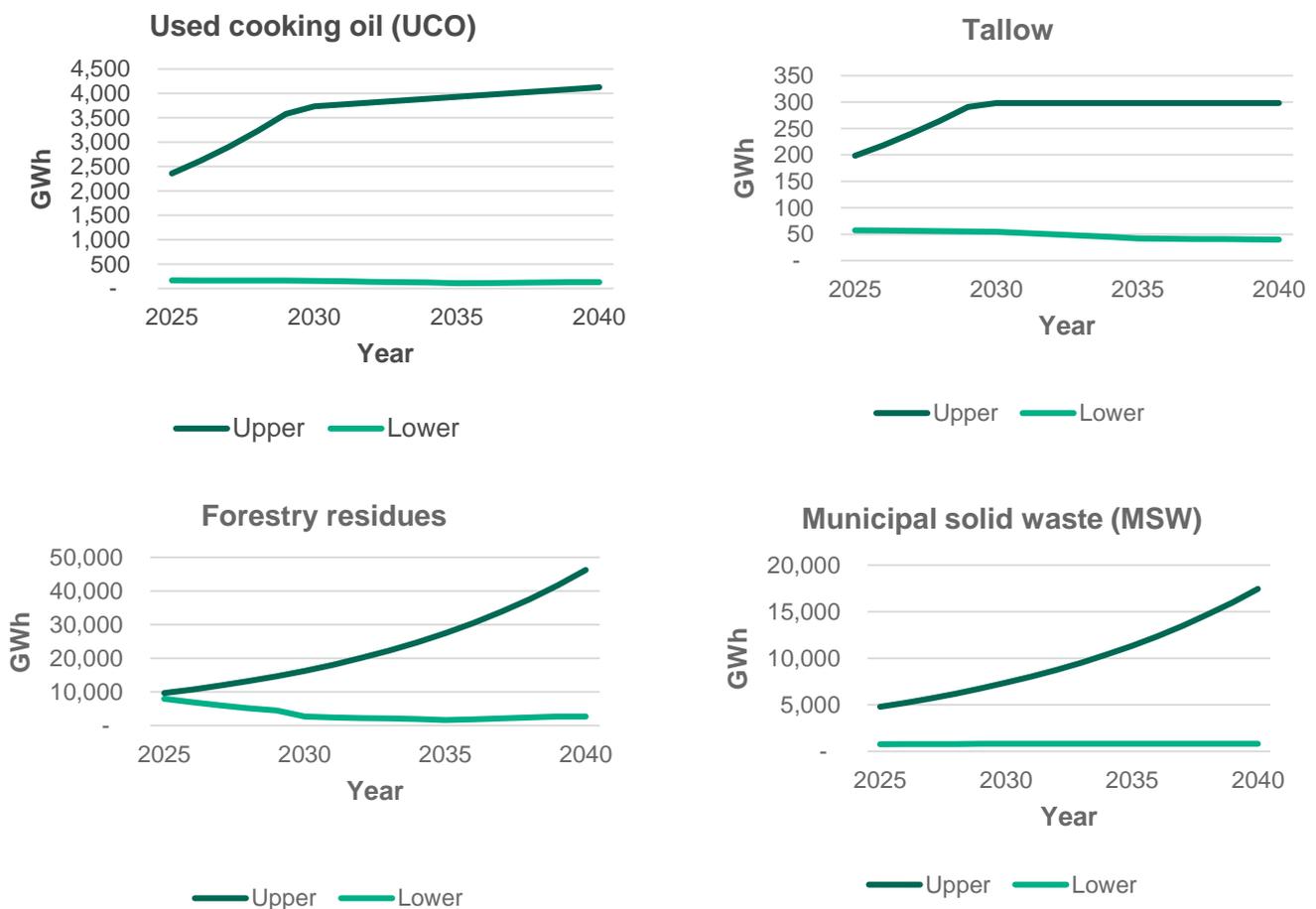


Figure 1: Graphs showing upper and lower bound assumptions on different forms of feedstock available to UK aviation

CALL FOR EVIDENCE

1. We welcome any further evidence on feedstock availability for SAF production. In particular, any evidence which takes into account:

- The feedstock availability worldwide required to meet planned SAF production, and competing demands with other sectors
- The need for feedstocks in other sectors and the GHG emissions savings and cost impact that any displacement could have
- Evidence from SAF producers on any feedstock agreements they have and the amount of feedstocks they may have access to.

Origin of SAF under the mandate

The SAF mandate will not differentiate between SAF made in the UK and that made overseas. Therefore, all trajectories set out in this consultation assume that the mandated UK SAF mix will be made from a combination of domestically produced and imported SAF. Having a SAF supply which includes a combination of domestic production, imports and exports should provide a more resilient supply system. The conclusion that some trajectories cannot not be met under the low feedstock availability scenario takes into account the availability of both domestically produced SAF and imports.

2025 target and trajectory to 2030

As stated previously, we have confirmed a target of 10% SAF in the UK aviation fuel mix by 2030, but we have not yet set the target in 2025 or the overall trajectory to get us there. In our first consultation, all trajectories started at 0.5% in 2025 but based on new information and feedback from stakeholders, we have modelled a variety of starting targets.

Figures 2 and 3 below outline our current target and trajectory options to 2030.

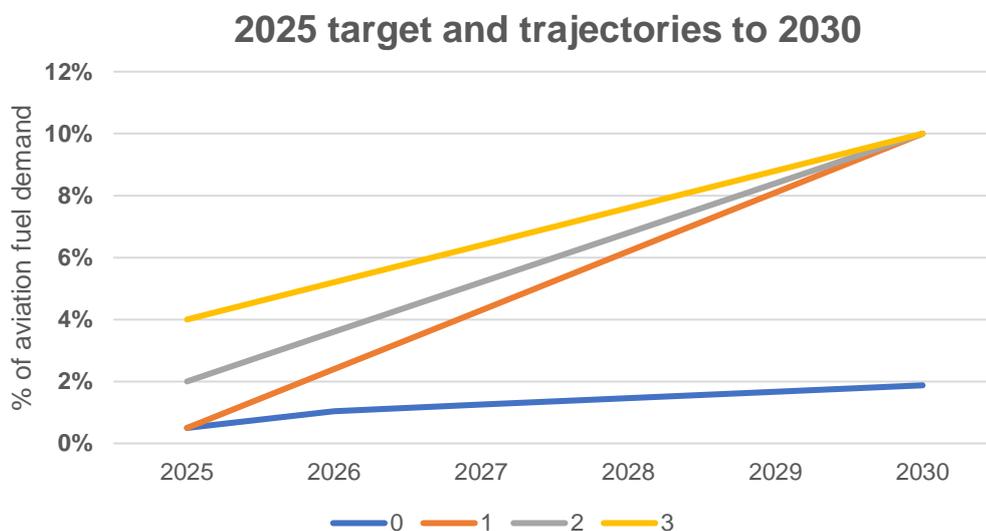


Figure 2: Target trajectories from 2025 to 2030 as a percentage of UK aviation fuel demand.

	2025	2030
0 – BAU	0.5%	2%
1 - Low	0.5%	10%
2 – Medium	2%	10%
3 - High	4%	10%

Figure 3: Target trajectories from 2025 to 2030 as a percentage of UK aviation fuel demand

Option 0 – Business as usual (BAU)

The ‘business as usual’ scenario set out above is the baseline against which the mandate proposals are measured. It assumes that a mandate is not introduced, and that there is no additional policy or financial support for the UK SAF industry beyond what has already been announced. In the absence of a mandated obligation on SAF, UK SAF supply is assumed to be low due to a lack of demand certainty. Uptake is assumed to reach 2% of UK jet fuel demand by 2030. This is in line with the Jet Zero Strategy’s ‘continuation of current trends’ scenario. This also aligns with emerging evidence from the RTFO, where until now, limited SAF has been supplied.

The SAF used under the BAU scenario is assumed to be almost entirely made up of the cheapest and most widely available fuel pathways such as HEFA. This aligns with evidence from the RTFO, where the only SAF supplied thus far has been HEFA. Without the introduction of a mandate there would be no cap on HEFA and a lack of incentive to invest in more advanced and expensive fuel pathways.

Option 1 - Low

Option 1 represents the lowest of the proposed trajectories, which is still highly ambitious and in line with our high ambition scenario in the first mandate consultation. The level of the mandate as a proportion of UK aviation fuel use begins at 0.5% in 2025 and increases sharply at a linear rate to 10% in 2030.

Option 2 - Medium

Option 2 represents the central trajectory. The level of the mandate as a proportion of UK aviation fuel use begins at 2% in 2025. This is in line with proposed 2025 uptake targets in other similar international schemes. The mandated level then rises linearly to 10% in 2030.

Option 3 - High

Option 3 represents the highest ambition trajectory. The level of the mandate as a proportion of UK aviation fuel use begins at 4% in 2025, rising linearly to 10% in 2030.

Under low feedstock availability assumptions, only the low 2025 target (Option 1) is achievable, although even on this low trajectory there is assumed to be insufficient feedstock

availability to continue to meet mandate targets as we move closer to 2030 (see figure 4 below).



Figure 4: Graphs showing feedstock implications of mandate trajectory options in a low feedstock scenario.

Under high feedstock availability assumptions, all, apart from the high 2025 target are achievable. However, when we move to 2027 in the high trajectory option, the target can again be met. All trajectories can meet the target of 10% SAF by 2030 in the high feedstock scenario (see figure 5 below). As this is a range, it is likely that actual feedstock availability lies somewhere between the low and high assumptions.

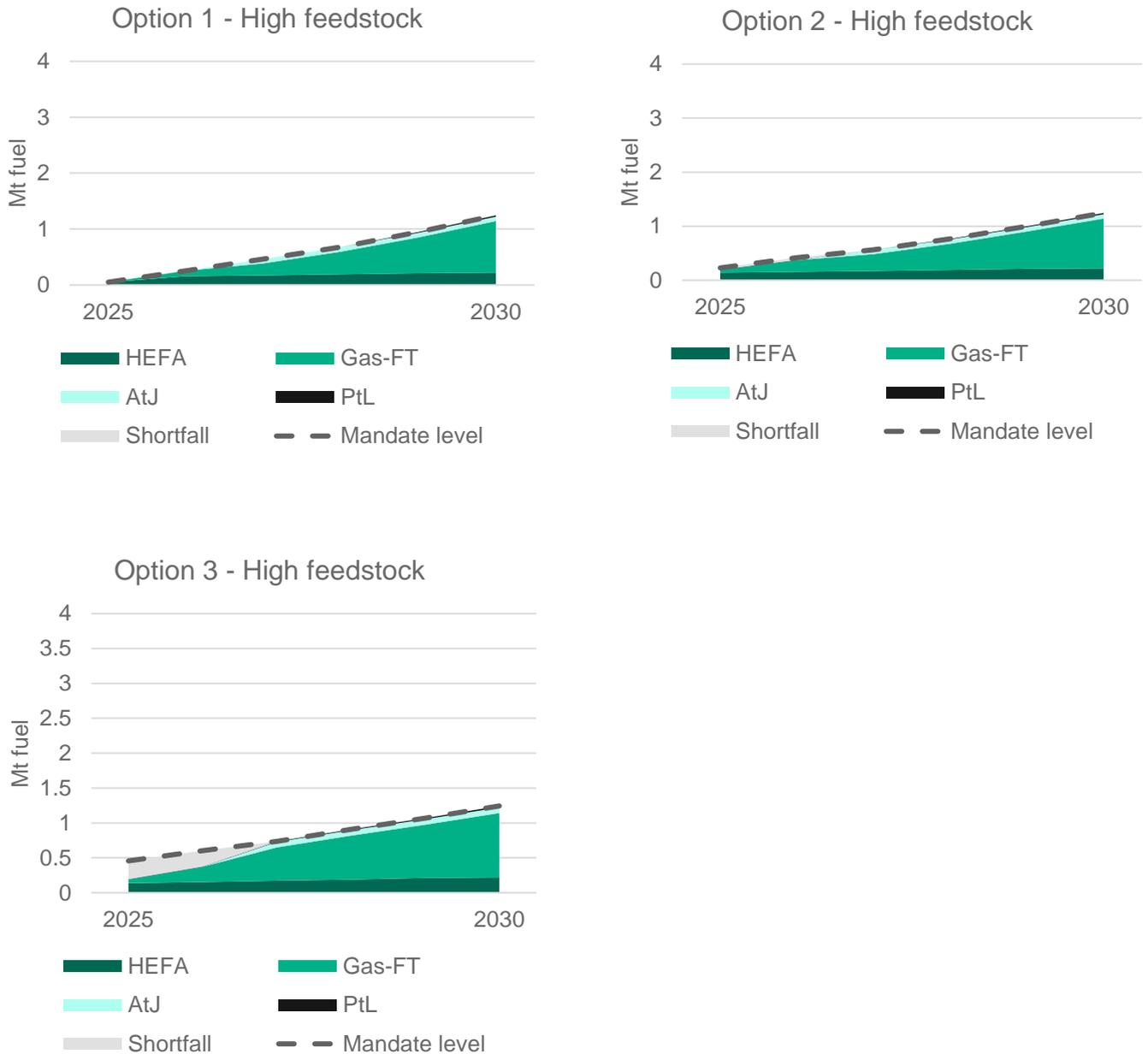


Figure 5: Graphs showing feedstock implications of mandate trajectory options in a high feedstock scenario.

It is important to keep in mind that the UK SAF industry will still be in its infancy in 2025 and is unlikely to be producing large volumes of SAF. If we set a target that is higher than can be met by industry in the early years, there will likely be a high level of buy-out. On the other hand, if we set a target that is too low, the industry may not have scaled up their production capacity enough to meet the target of 10% SAF by 2030. There is a fine balance required between having a high ambition and providing demand certainty, and potentially being over-ambitious and increasing costs without GHG emissions savings.

As set out previously, we aim to update our feedstock modelling based on the findings from the Low Carbon Fuels and Biomass strategies before we publish a government response to this consultation. This should provide us with a degree more certainty on feedstock availability to bolster our target/trajectory options.

CONSULTATION QUESTION

Q1: Which 2025 target option strikes the right balance between ambition and deliverability? Do you have any evidence to support your position?

Q2: Would you find it acceptable if the trajectory from 2025 to 2030 was set at an ambitious level and this led to high levels of buy-out and increasing costs to consumers?

Setting increasing targets into the future

Due to the uncertainty in the data and modelling that we have out to 2050, as a result of the market being in the early stages of development, we **propose that we only set out increasing targets in legislation up to 2040**. This does not mean that targets end in 2040 but that they will continue at the 2040 level until they are reviewed and updated. This is in line with how the RTFO has operated since it started.

We recognise that certainty is of the utmost importance to the industry. We consider that setting targets beyond 2040 on the basis of such uncertain evidence could risk undermining the industry if targets are judged to be too ambitious in the future and require reducing.

In line with our review process, we propose that targets be kept under continuous assessment and are formally reviewed on an at least 5-yearly basis (see [section](#) on mandate review points). Alongside these reviews, we will ensure that we update targets from 2040 onwards early enough to allow time for producers to increase production capacity and to provide a level of investor certainty that SAF will have a market in the UK.

CONSULTATION QUESTION

Q3: Do you have any comments on the post 2040 proposal to legislate for targets continuing at the 2040 level, with the plan to update these when better data is available?

Trajectory options from 2030 onwards

Apart from the 'BAU' option, all of our trajectories for 2030 onwards begin at 10% SAF in 2030, as we have already confirmed this target in the Net Zero Strategy, Jet Zero Strategy and our first consultation government response. In line with our proposal to legislate increasing targets to 2040, the figures we present below end in 2040 on the graph. In reality, these will continue at the 2040 level with the option to increase targets at a later date. As with the 2025 to 2030 targets, we have set out three options alongside a business-as-usual baseline.

Figures 6 and 7 below outline our current target and trajectory options from 2030 onwards. Figure 8 shows the potential level outlined trajectories could meet if trends continued to 2050.

SAF mandate trajectory options - post 2030

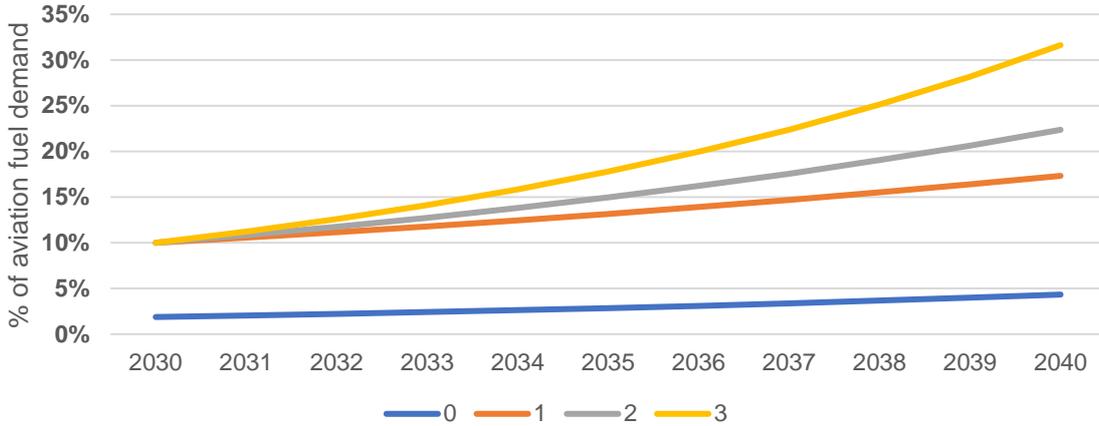


Figure 6: Increasing target trajectories from 2030 to 2040 as a percentage of UK aviation fuel demand.

	2030	2035	2040
0 – BAU	2%	3%	4%
1 - Low	10%	13%	17%
2 – Medium	10%	15%	22%
3 - High	10%	18%	32%

Figure 7: Increasing target trajectories from 2030 to 2040 as a percentage of UK aviation fuel demand.

SAF mandate trajectory options continuation of trends

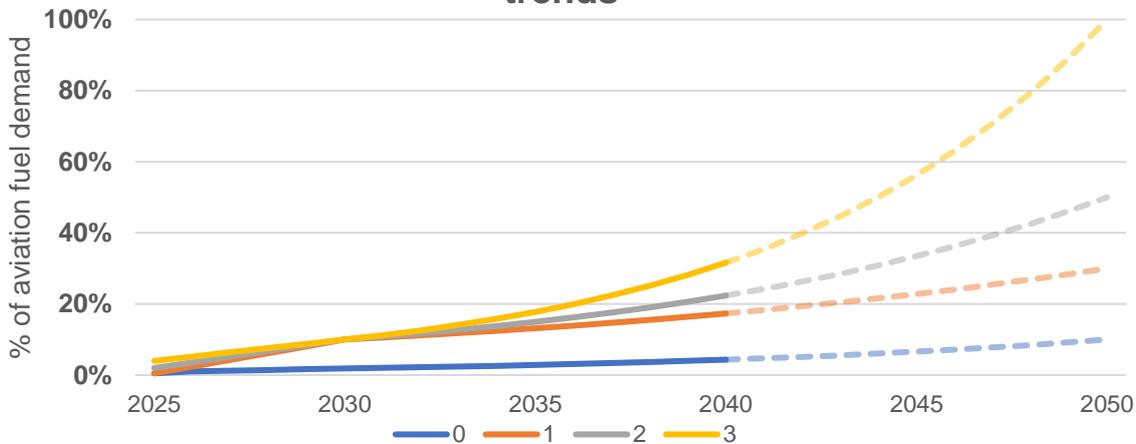


Figure 8: SAF mandate trajectory options continuation of trends.

Option 0 – Business as usual (BAU)

The BAU scenario set out above is the baseline against which the mandate proposals are measured. Under this scenario, SAF makes up 4% of total UK aviation fuel by 2040. Again, in the absence of a mandated obligation to supply SAF, UK SAF supply is assumed to be low due to lack of demand certainty. This is in line with the assumed SAF uptake in the Jet Zero Strategy’s ‘continuation of current trends’ scenario. If this trajectory continued up to 2050, it could reach up to 10% of aviation fuel demand.

Option 1 - Low

Option 1 represents the lowest of the proposed trajectories, though still highly ambitious and in line with our high ambition scenario in the first consultation. After increasing sharply from 0.5% in 2025 to 10% in 2030, this trajectory continues to increase to 17% in 2040, bringing the SAF mandate target in line with the total RTFO target level. If this trajectory continued up to 2050, it could reach up to 30% of aviation fuel demand.

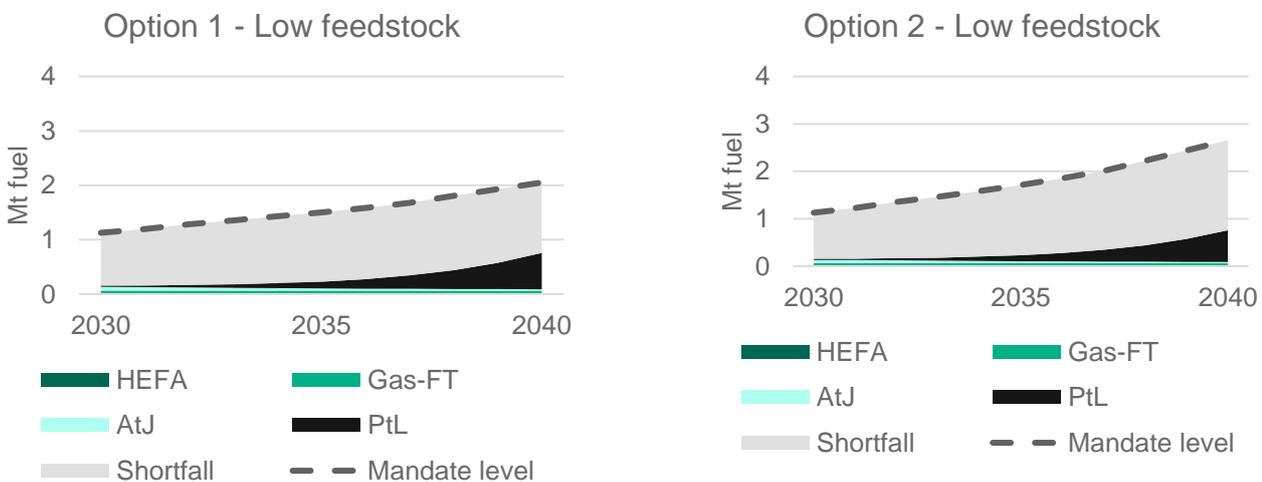
Option 2 - Medium

Option 2 represents the central trajectory. After rising linearly to 10% in 2030, this trajectory increases to 22% in 2040 which is in line with the Jet Zero Strategy ‘High Ambition’ scenario. If this trajectory continued up to 2050, it could reach up to 50% of aviation fuel demand.

Option 3 - High

Option 3 represents the highest ambition trajectory. This trajectory increases exponentially from 10% in 2030 to 32% in 2040. This is in line with the Jet Zero Strategy ‘High ambition with a breakthrough on SAF’ scenario. If this trajectory continued up to 2050, it could reach up to 100% of aviation fuel demand.

Under low feedstock availability assumptions, there are insufficient levels of feedstock available to continue to meet mandate targets from 2030 onwards, even in our low trajectory option (see figure 9 below).



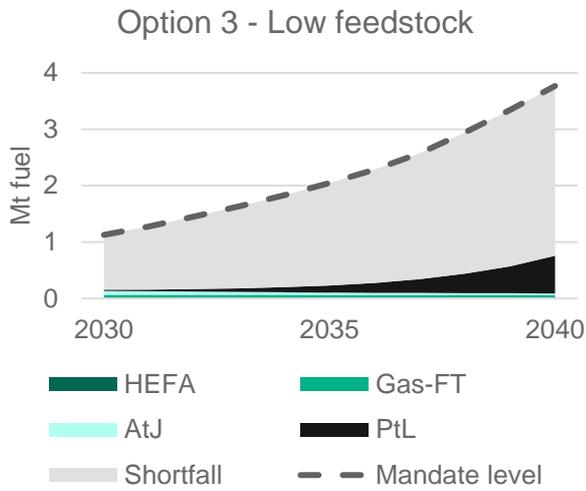
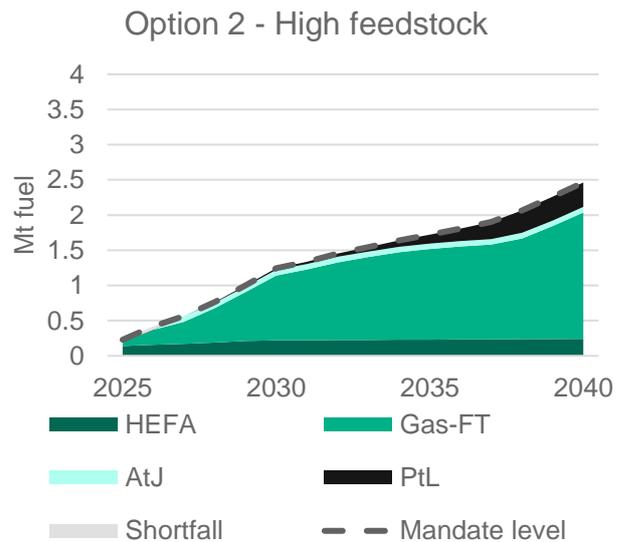
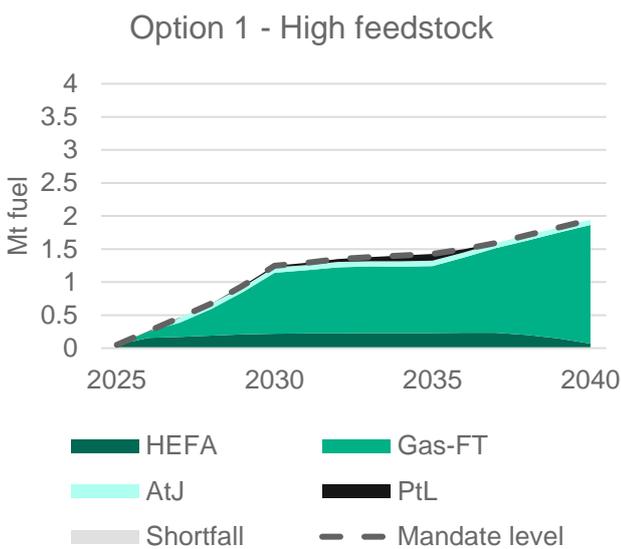


Figure 9: Graphs showing feedstock implications of mandate trajectory options in a low feedstock scenario.

Under high feedstock availability assumptions, all proposed targets from 2030 onwards are achievable from a feedstock standpoint (see figure 10 below). Again, the feedstock data we present falls within a range between high and low availability, and actual availability will fall somewhere between these.



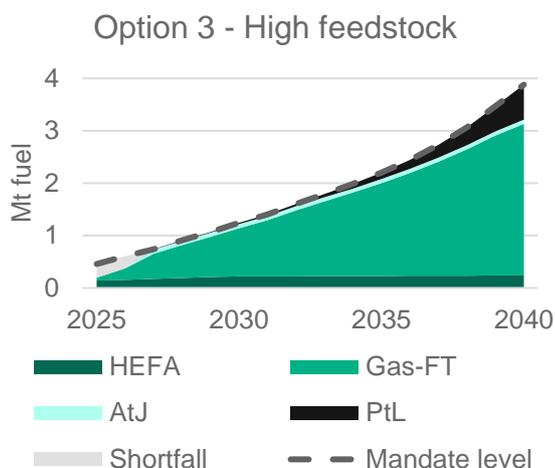


Figure 10: Graphs showing feedstock implications of mandate trajectory options in a high feedstock scenario.

In setting a trajectory from 2030 to 2040, it is important that targets are both ambitious and deliverable. If targets are set too high, and we do not have the feedstock availability needed to produce the levels of SAF necessary to meet demand, suppliers will buy out of their obligations, potentially increasing costs for consumers. If we set targets too low, we won't create enough demand for SAF or a high enough incentive for suppliers and may lose GHG emissions savings. This could also lead to the UK losing domestic production facilities if producers decide to relocate to countries with higher incentives.

CONSULTATION QUESTIONS

Q4: What increasing trajectory to 2040 do you think strikes the right balance between ambition and deliverability? Do you have any evidence to support your position? Q5: Do you have an alternative trajectory option you would prefer to see, and do you have evidence to support this?

Q6: Would you find it acceptable if the trajectory from 2030 onwards was set at an ambitious level and this led to high levels of buy-out and increasing costs to consumers?

HEFA cap

The need for a HEFA cap

HEFA is currently the cheapest and most developed SAF type, which may make it attractive to avtur suppliers from a business perspective. In our first mandate consultation government response we set out that a HEFA cap will be included in the SAF mandate. The purpose of a HEFA cap is to ensure that introducing a SAF mandate does not divert feedstock away from existing uses or raise concerns over sustainability by increasing demand for certain feedstocks. In particular, we want to ensure that HEFA use in aviation does not lead to diversion of feedstocks that are still required for the decarbonisation of difficult-to-decarbonise road transport vehicles. The potential remains for this to happen under a UK SAF mandate if no specific provisions are put in place to address it.

Additionally, a HEFA cap can help ensure that a variety of SAF production pathways which use a wide range of feedstocks are incentivised. This would reduce the risks that come with reliance on only one type of feedstock or processing technology, and in turn increase energy security. This should also help to encourage investment into less commercialised SAF production technologies which will be needed to ensure a diverse portfolio of production methods exists in the future.

Information on how HEFA will be defined under the mandate can be found in [Chapter 3](#).

Options for a HEFA cap

The development of a HEFA cap, like the main mandate targets, requires the use of feedstock availability data as well as modelling on the future needs of UCO and tallow feedstocks for road transport. As the feedstock data we currently have is uncertain, and future needs for UCO and tallow for road transport still largely unknown, we do not currently have the appropriate evidence to set out a preferred option. For this reason, we will again present a range within which the HEFA cap could fall, alongside considerations on where the cap should be set.

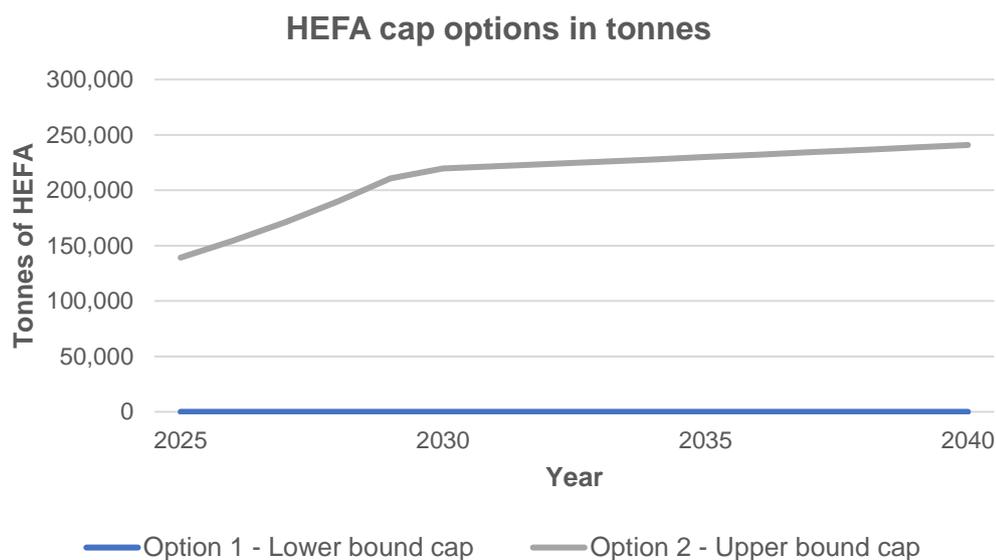


Figure 11: Graph showing upper and lower bound HEFA cap range in tonnes of HEFA.

Lower bound: The lower bound HEFA cap option has been modelled to allow demand for UCO and tallow under the RTFO to be met first and to then allow any remaining feedstock to be used for SAF production. As there are limited amounts of UCO and tallow in the lower bound feedstock scenario, the modelling caps HEFA uptake at 0% of mandated SAF uptake. This approach would ensure that RTFO demand for UCO and tallow would continue to be met, and none of this feedstock would be displaced for the development of SAF. However, HEFA is the cheapest and most readily available form of SAF, and it is expected that in the absence of a cap, it would make up the majority, if not all of SAF supply under the mandate in early years. A 0% HEFA cap could therefore lead to high levels of buy-out from the

mandate and increased costs to industry and consumers without any of the GHG emissions savings desired from SAF.

Upper bound: The upper bound HEFA cap option is set at the maximum level of HEFA modelled in the AIA model scenarios. The AIA model calculates the most economic fuel mix each year to meet the proposed mandate level, given the relative cost-effectiveness of the emissions reductions associated with the use of SAF, and constrained by the assumed availability of feedstocks. To get to this high cap option we have input the high trajectory and high feedstock scenario, which shows us the highest level of HEFA we could potentially use within the mandate.

Setting the cap at this high level would likely reduce the cost impact of the mandate on the aviation sector in the early years, as quite a large proportion of HEFA would still be allowed. However, depending on where we set the 2025 target, varying levels of buy-out could still occur as other forms of SAF will not yet be available in large volumes.

This upper bound cap option could lead to competition for feedstocks and the diversion of feedstocks from use in road transport to use in aviation. This could mean less biodiesel for use in difficult-to-decarbonise road transport vehicles and a loss of GHG emissions savings. This could also potentially mean that RTFO suppliers of biodiesel would not have sufficient volumes to meet their RTFO obligations, and may need to buy out, leading to higher costs for road transport users.

In summary, the considerations to be made on each option include:

Lower bound: The lower bound, or a HEFA cap of zero could lead to high levels of buy-out, high costs to the aviation industry with no GHG emissions savings. This option would safeguard feedstocks for difficult-to-decarbonise road transport, where feedstocks can be used slightly more efficiently.

Upper bound: The upper bound, or a HEFA cap of the maximum amount of HEFA uptake modelled in a high feedstock scenario could lead to less buy-out, but high competition for feedstocks and the potential for diversion of feedstocks needed for difficult-to-decarbonise road transport to aviation. This would have a negative impact on road GHG emissions savings but a positive impact on aviation emissions savings.

The final cap is expected to be set somewhere between the high and low options and will be updated with further feedstock modelling information when this is available. Additionally, as with all of our targets, the HEFA cap will be kept under review throughout the mandate process and can be updated based on new information or data on how it is working in practice.

CONSULTATION QUESTIONS

Q7: Do you agree with where we have set our HEFA cap upper and lower bounds (upper bound is highest HEFA uptake modelled under the mandate, lower bound is no HEFA in the mandate)? Do you have any evidence to support this?

Q8: Do you agree that we should try to limit the diversion of feedstocks from difficult-to-decarbonise road transport modes as much as possible?

Q9: At what level do you think a HEFA cap should be set to balance mandate deliverability with road transport decarbonisation?

CALL FOR EVIDENCE

2. The Department would welcome data from respondents to improve the evidence base used to calculate the appropriate HEFA cap level, such as data on the availability of feedstocks for HEFA and the rate of deployment of technology globally.

Power-to-liquid (PtL) mandate

The need for a power-to-liquid mandate

PtL production technology is still in the development stages and costs are currently significantly higher than those of other forms of SAF. This is expected to continue, particularly in the early years of the mandate while the technology scales up and low carbon electricity, hydrogen and carbon capture costs are also expected to be high.

The purpose of a PtL mandate, like the development fuels sub-target in the RTFO, is to specifically incentivise the supply of this 'development fuel' with high GHG emissions savings potential and low land use change risk. The PtL mandate will have a separate, higher, buy-out price to account for the higher costs of producing the fuel. This higher buy-out price will effectively set a higher maximum price for mandate certificates than under the main mandate obligation, as it is assumed that a supplier will choose to pay the buy-out price rather than supply eligible fuel or purchase certificates at a higher cost. Ultimately however, the price of certificates is movable and set by the market. A PtL mandate will help to indicate that there will be a market for these fuels in future, demonstrating demand and incentivising investment, production and supply.

In setting the PtL targets, it is important that we do not set them too high too early in the mandate lifespan, as the technology is still under early development and large volumes will likely not be available in the early years of the mandate. Setting targets too high too early could lead to buy out and increased costs to the consumer without any GHG emissions savings.

Information on how PtL will be defined under the mandate can be found in [Chapter 3](#).

Options for a power-to-liquid mandate

Figures 12 and 13 below set out potential trajectory options for a PtL mandate. As with our main mandate trajectories, we have set these out to 2040 with the proposal to develop PtL mandate targets for post-2040 uptake when main targets are being put in place. In our modelling, PtL availability is assumed to grow post-2035 when the technology is expected to become commercialised and access to cheaper low carbon energy is achieved.

Power-to-liquid mandate range as percentage of total jet fuel demand

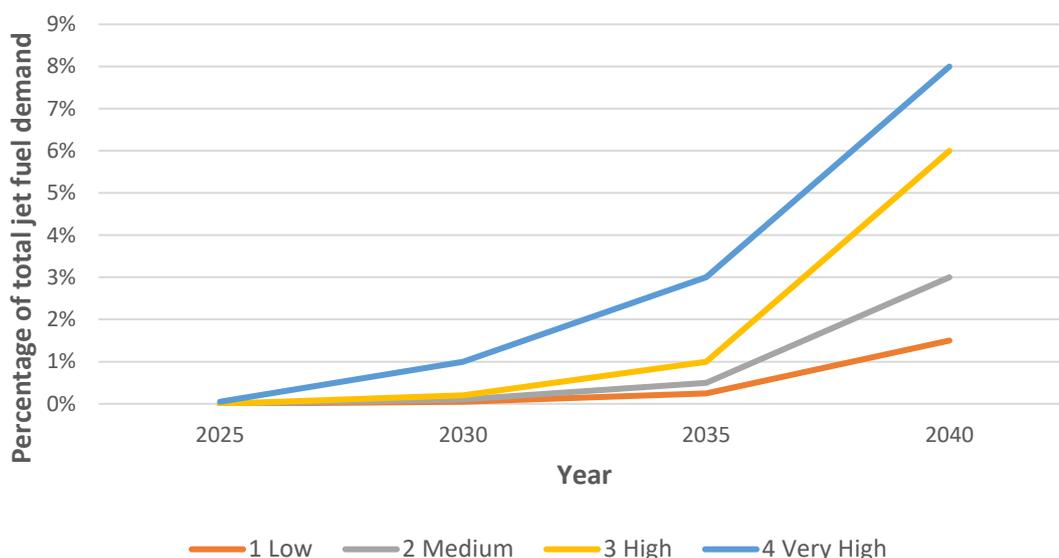


Figure 12: Graph showing PtL mandate range as a percentage of total jet fuel demand.

	2025	2030	2035	2040
1- Low	0%	0.05%	0.25%	1.5%
2- Medium	0%	0.10%	0.50%	3 %
3- High	0%	0.20%	1%	6%
4- Very High	0.05%	1%	3%	8%

Figure 13: PtL mandate range as a percentage of total jet fuel demand.

Low: The low PtL mandate trajectory is set at a quarter of the maximum uptake of PtL calculated under the AIA modelling. Unlike with the HEFA cap, PtL availability in the AIA modelling is not constrained by feedstocks, but by direct air capture (DAC) availability. This trajectory starts at 0% of total jet fuel demand in 2025 and reaches 1.5% in 2040. The low trajectory has been modelled to represent a scenario where production does not reach the level expected, or costs remain higher than expected. Setting the PtL mandate at this level would mean a heavier reliance on SAF made from waste-based feedstocks, which may be in low supply and high demand.

Medium: The medium trajectory option is set at the midway point between our high and low trajectories. This trajectory starts at 0% of total jet fuel demand in 2025 and reaches 3% by 2040. This trajectory has been modelled to represent a scenario where production may not reach the maximum level possible, but still ramps up significantly out to 2040.

High: The high trajectory option is set at the maximum uptake of PtL calculated under the AIA modelling. This trajectory starts at 0% of total jet fuel demand in 2025 and reaches 6% by 2040. This option would provide a high incentive to supply PtL and signal to producers as well as investors that there will be increasing demand for PtL out to 2040 and beyond. As this is the highest potential uptake of PtL in our modelling, and this modelling remains uncertain, there is a chance that this trajectory is too high and that a mandate set at this level could lead to high levels of buy-out and high costs to industry without GHG emissions savings.

Very high: The very high trajectory is set at a level higher than projected by the AIA data and has been developed in line with similar schemes in other regions. This trajectory starts at 0.05% of total jet fuel demand in 2025 and reaches 8% by 2040. Current modelling suggests that this trajectory is not possible within the limitations of PtL technological development. This option would provide a very high incentive to supply PtL but based on current modelling this is unlikely to be met by industry and would lead to high levels of buy-out.

When considering the most suitable PtL target trajectory, it is important to consider the most suitable timing for a PtL mandate to come into force. Current modelling shows that there is unlikely to be any PtL in 2025 and very small volumes from 2026 to the mid-2030s. It is very difficult to accurately forecast how much PtL there will be in the future, meaning if we set a PtL target too early, we may only see buy-out and no GHG emissions savings. However, if we don't set a PtL target early enough and there is PtL available on the market, it will likely not be used in the UK but elsewhere where incentives exist. There is a balance to be struck between the need to provide a high enough incentive for PtL whilst also trying not to pass extremely high costs onto industry.

As PtL production relies on the use of low carbon electricity, low carbon hydrogen and a source of CO₂, it is also important to consider the low carbon energy, hydrogen and CO₂ requirements PtL production could have, and how the availability of, and access to these could impact on production capacity. The modelled PtL uptake of 6% in 2040 in our 'high' trajectory option could require around 22 TWh of low carbon electricity, 11 TWh of low carbon hydrogen, and 8 TWh of CO₂. To put this into context, UK renewable electricity generation is currently 140 TWh per year, and the UK's ambition for low carbon hydrogen production capacity is at least 5 GW of electrolytic hydrogen by 2030.

It is probable that both low carbon electricity and low carbon hydrogen will be in high demand for other uses such as road transport electrification and hydrogen industrial processes. Similarly, other forms of SAF also require the use of low carbon hydrogen in the production process, so this must also be considered. There are risks associated with the feasibility of scaling up low carbon electricity and hydrogen generation capacity to meet these needs, alongside wider demands for both as the economy decarbonises. Each additional unit of electricity and hydrogen will require additional infrastructure which will ultimately be an additional cost to UK consumers. It is however important to note that we do not assume that all PtL (or indeed all SAF) supplied under the mandate will be domestically produced, some demand will likely be met through imports. This means that not all of the low carbon electricity and hydrogen that will be required in the PtL SAF production process to help meet the mandate will come from the UK. We will continue to work to understand the potential impact of both SAF in general and PtL specifically on the UK's future low carbon energy and hydrogen capacity and usage.

CONSULTATION QUESTION

Q10: At what level do you think a PtL mandate should be set to strike the right balance between ambition and deliverability? Do you have any evidence to support your choice, in particular considering low carbon electricity and hydrogen production, as well as carbon capture requirements?

Q11: In which year do you think it would be most appropriate for a PtL mandate to start and how quickly do you think ambition should ramp up?

How the SAF mandate provides price support for SAF

The SAF mandate will create a market and demand for SAF through setting annual obligations on suppliers of obligated fuel. This obligation can be fulfilled through redeeming certificates issued for the supply of SAF or discharged through paying to buy out of the obligation.

The SAF mandate scheme is intended to close the gap between the price of fossil kerosene and the additional cost of producing and supplying SAF. SAF producers will receive price support for SAF via the mandate scheme either directly (through earning certificates themselves), or indirectly given that obligated parties are willing to pay a premium over the cost of fossil kerosene for the SAF to fulfil their obligations.

It is intended that under normal market conditions obligated parties would supply SAF rather than use the buy-out mechanism – that is, it is cheaper for them to supply SAF (or purchase certificates from others who have supplied SAF) than to discharge their obligation through the buy-out.

In line with the way the RTFO operates, we anticipate that support for SAF flows up the supply chain to the SAF producer and the costs are passed on to the end user, i.e. the airline passenger and cargo operator.

Although the mandate provides price support and sends an important long-term signal to investors that now is the time to invest, we recognise that it may not provide long-term revenue certainty for UK SAF production facilities. This is mainly due to the uncertainty in what price the certificates will achieve. As mentioned previously, following the publication of Philip New's independent evaluation on developing a UK SAF industry and the government response to this, the government will continue to work in partnership with industry and investors to explore the best approach to addressing barriers to investment, including future revenue certainty, with a focus on industry-led intervention.

Buy-out price

The purpose of a buy-out mechanism

In the government response to our first mandate consultation, we confirmed that a buy-out mechanism will be included in the UK SAF mandate. The purpose of a buy-out mechanism is to provide a way for suppliers to discharge their mandate obligation in cases where they are unable to secure a supply of SAF, for example in the case of supply chain issues, or if

there are unusually high spikes in costs. This in turn helps to ensure that disproportionately high costs are not passed on to consumers.

Although the buy-out does create an alternative way for suppliers to discharge their obligation, it does not lead to GHG emissions savings. It is therefore not intended to be used as a long-term form of compliance, but only in exceptional circumstances. The buy-out price also effectively sets the maximum price for mandate certificates, as it is assumed that a supplier will choose to pay the buy-out price rather than supply eligible fuel or purchase certificates at a higher cost. This means that it also sets the maximum incentive that will be available for supplying SAF under the mandate.

Setting the buy-out price at the right level

It is important that the buy-out price is set at the correct level to ensure that maximum GHG emissions savings can be delivered from the scheme at an acceptable cost. A buy-out price that is set too low will increase the likelihood that suppliers will buy out of their obligations, and therefore the possibility that GHG emission savings from the scheme will be reduced. This would reduce the incentive to supply and invest in SAF, in particular SAF produced using newer and more expensive pathways.

Alternatively, a high buy-out price could help protect GHG emissions savings by ensuring that suppliers supply SAF to meet the mandate when it is available. A buy-out price that is set too high however would not protect consumers against disproportionately high costs. Any potential cost impacts need to be taken into consideration when setting a buy-out price.

The ideal buy-out price would:

- Encourage the supply of SAF and trading of certificates over the use of the buy-out, hence securing GHG emissions savings;
- Future-proof against price fluctuations in the fuels market;
- Prevent extremely high costs from being passed onto consumers.

Buy-out price options

Figure 14 below sets out our proposed main mandate buy-out price options. Further information on the change in costs and benefits to the mandate based on buy-put price options can be found at page 53 of the CBA document.

Option	Explanation	£/tonne	£/litre
Low	RTFO development fuel buyout price	£2,051	£1.60 ⁷
Medium	Pessimistic production costs	£2,567	£2.00
High	Pessimistic production costs plus margin	£3,846	£3.00

Figure 14: Buyout price options considered.

Low: The low buy-out price option is the Development RTFO (dRTFO) buy-out price. This is the maximum incentive currently available for SAF under the RTFO.

Medium: The medium buy-out price of £2 per litre or £2,567 per tonne has been calculated by taking the pessimistic production costs (i.e., most costly production) of the most expensive SAF production pathway and subtracting the price of kerosene. This calculation excludes PtL as this will be subject to its own mandate and therefore a separate buy-out price.

High: The high buy-out price of £3 per litre or £3,846 per tonne has been calculated by taking the pessimistic production costs of the most expensive SAF production pathway, subtracting the price of kerosene, and adding a margin of 50% to account for potential price volatility that may occur in the market. This volatility margin was chosen by examining the average variation in the cost differential between SAF and conventional kerosene over the course of the last year, with price data taken from Argus Media.

Buy-out price preferred option

In choosing a preferred option for the main buy-out price, we took a number of issues into consideration. When reviewing the low buy-out price option, we considered the views of some respondents to our first consultation who set out that the mandate buy-out price should be higher than the dRTFO buy-out price, as SAF is more expensive to produce than other types of development fuels. Based on the current pessimistic costs of SAF production, this low option may be too low, meaning that paying this buy-out would likely be cheaper than supplying SAF, leading to a loss of GHG emissions savings.

In contrast, the high buy-out price option may potentially be too high. In cases where there is not enough SAF available, this could lead to high costs to consumers with no GHG emissions savings.

Taking into account these considerations, **we propose that the medium buy-out price option of £2 per litre, or £2,567 per tonne, is used as the main mandate buy-out price.**

⁷ The buy-out price for development fuels under the RTFO is £0.80 per litre, but as qualifying fuels are rewarded with double certificates, this equates to £1.60 per litre, or £2,051 per tonne in the case of qualifying SAF.

Our evidence suggests that this price should cover the production costs of all SAF types included in the main mandate, which excludes PtL. Additionally, as we are using the most pessimistic cost of production for the most expensive form of SAF, actual production costs will likely fall below this figure, which would account for potential price volatility in the market. The buy-out price will be monitored closely for the duration of the mandate, and if needed can be reviewed and updated within our regular reviews.

CONSULTATION QUESTION

Q12: Do you agree or disagree with the proposed use of the medium buy-out price of £2 per litre or £2,567 per tonne for the main mandate, and do you have any evidence to support your response?

CALL FOR EVIDENCE

3. The Department would welcome data from respondents to improve the evidence base used to calculate the appropriate buy-out price, such as price data and/or projections of cost per tonne of SAF produced for different technologies.

Power-to-liquid buy-out price

We have set out previously that we will include a PtL target within the mandate. PtL is currently the most expensive SAF production pathway, and it is therefore necessary to have its own separate buy-out price to ensure these higher costs are covered.

The PtL buy-out price has the same function as the main obligation buy-out price, in that it provides an alternative way for suppliers to discharge their mandate obligation when they cannot access SAF, or the prices are prohibitively high.

Power-to-liquid buy-out price options

Figure 15 below sets out our proposed PtL buy-out price options. Further information on the change in costs and benefits to the mandate based on PtL buy-out price options can be found at page 63 of the CBA document.

Option	Explanation	£/tonne	£/litre
Low	Recommended option for main mandate	£2,567	£2.00
Medium	Pessimistic production costs	£3,525	£2.75
High	Pessimistic production costs plus margin	£5,320	£4.15

Figure 15: PtL buy-out price options considered.

Low: The low PtL buy-out option is the recommended buy-out price for the main mandate at £2,567 per tonne or £2 per litre. We have chosen this option as without a separate PtL target, PtL would be subject to this main buy-out price.

Medium: The medium PtL buy-out price option of £3,525 per tonne or £2.75 per litre has been calculated in the same way as the medium main buy-out price, by taking the pessimistic production costs of PtL and subtracting the price of kerosene.

High: The high buy-out price option of £5,320 per tonne or £4.15 per litre has been calculated in the same way as the high main buy-out price, by taking the pessimistic production costs of PtL, subtracting the price of kerosene, and adding a margin of 50%.

Power-to-liquid buy-out preferred option

We propose to use the medium buy-out price option of £2.75 per litre, or £3,525 per tonne, as the PtL buy-out price. This aligns with our reasoning for choosing the medium option for the main buy-out price, as it is based on pessimistic production costs which are assumed to be higher than actual production costs to account for some price volatility. As with the main buy-out price, the PtL buy-out price will be monitored closely and formally reviewed in our regular review process.

CONSULTATION QUESTION

Q13: Do you agree or disagree with the proposed use of the medium buy-out price of £2.75 per litre or £3,525 per tonne for the PtL mandate, and do you have any evidence to support your response?

Duration of buy-out throughout mandate

Some responses to our first mandate consultation suggested that the buy-out should only be a feature of the mandate in the early years. Arguments for this approach suggested that the industry will still be developing in the early stages of the mandate and there could be a shortage of SAF supply to meet targets, therefore necessitating the availability of a buy-out. However, as the market develops there should be no reason to buy out as there would be a reliable supply of SAF available. Some respondents also raised concerns that the buy-out would be used as a regular form of compliance if it was available for the duration of the mandate policy.

Although it is assumed that as the market develops more SAF will be available, this does not mean that unexpected spikes in the market price of SAF will not occur, or that there may not be unforeseen supply chain issues or feedstock shortages in later years. The buy-out is designed to be a way for suppliers to discharge their mandate obligation in these types of unforeseen circumstances. **We therefore propose that the buy-out remains in place for the duration of the mandate.**

The level of buy-out will be kept under continuous review and will also be formally reviewed every five years within our general five yearly reviews. This, along with setting the buy-out price at the correct level to begin with, is designed to protect against the use of the buy-out as a frequent compliance mechanism.

CONSULTATION QUESTION

Q14: Do you agree or disagree with the proposal that a buy-out mechanism should be a permanent feature of the mandate?

Mandate review points

In the government response to our first consultation, we indicated that we would include a regular review process within the SAF mandate, and that we would further consider the structure and timing of a review process before making a final decision on this point. Any formal review would include a consultation process to gather stakeholder views.

What information could we review?

Reviews will consider whether the mandate policy is doing what it has set out to do: securing UK demand for SAF by obligating aviation fuel suppliers to reduce their GHG emissions through SAF supply. They will also consider if the objectives of the mandate remain appropriate, and if so, if they could be achieved in other ways more easily.

Information to be reviewed could include, but would not be limited to:

- **Level of supply against targets.** Amounts of SAF supplied as a result of the mandate and the GHG emissions savings achieved due to this supply.
- **Targets, HEFA cap, PtL mandate and buy-out levels.** Are these set at the correct level based on the current UK and global landscape? Are targets being met or exceeded and do they need to be adjusted? How frequently is the buy-out being used and does the price need to be updated?
- **Fraud/noncompliance.** Has fraud or noncompliance been detected within the scheme? Are there ways to mitigate this? Are our penalties effective?
- **Feedstock and energy availability.** What is feedstock and energy availability worldwide and how much of this is available for SAF production? Is the SAF mandate impacting on feedstock availability for other difficult-to-decarbonise transport modes, and if so, how do we mitigate this?
- **Sustainability criteria and GHG emissions threshold.** Do we need to update our sustainability criteria based on new scientific information or potential loopholes in the legislation? Has the SAF production process become more efficient or has the availability of CCS increased to a level that allows the increase of our GHG emissions threshold and the assumed average GHG emissions savings from SAF?
- **Costs/benefits.** The potential costs of the policy as well as potential impacts, for example, green jobs, green finance, building industrial capacity, costs to industry and consumers.
- **Industry updates.** What does the SAF industry look like both in the UK and worldwide?
- **Progress of other decarbonisation modes for aviation.** How advanced are other modes of aviation decarbonisation such as electrification, hydrogen and system efficiencies and how does this impact on mandate targets? For instance, is less liquid fuel needed, so our proportion targets could be increased?

When conducting reviews, we will ensure that our work aligns with Jet Zero Strategy reviews as well as with other relevant wider government policies and strategies. We will also take into consideration how our targets and their potential GHG emissions impacts link in with relevant carbon budgets.

When will we review?

We propose that we keep the information above under continuous review, but that official reviews are conducted and published at least every five years. This means that a formal review may be carried out before the five-year point, but not after.

This approach allows us to remain flexible to emerging issues within the mandate and to respond accordingly.

CONSULTATION QUESTION

Q15: Do you agree or disagree with the information we could include in our reviews? Is there anything you feel we haven't considered but should?

Q16: Do you agree or disagree with our proposed flexible approach to review timelines?

3. Eligible fuels and sustainability criteria

Prescribing robust sustainability criteria is critical to ensuring that the mandate only supports SAF that delivers genuine GHG savings and prevents negative environmental consequences such as the loss of biodiversity, deforestation and the loss of other land with high carbon stock (e.g. peatland) that is associated with some feedstocks.

In July 2022 the government response to the SAF mandate confirmed the high-level technical and sustainability criteria that will ensure the mandate will deliver fuels with the highest sustainability credentials, while also maintaining appropriate safety standards. This included confirmation that SAF must be made from biofuels derived from wastes or residues, RCFs, or PtL using low carbon electricity (i.e. generated from renewable or nuclear sources).

The following chapter builds on the commitments made in the government response to provide further clarity on the key sustainability criteria that will be introduced in legislation. As mentioned elsewhere in this consultation, a guidance document will be published ahead of the mandate commencing, providing in-depth detail of how these criteria are to be applied in practice.

Fuel types

Fuels subject to the obligation

The government has already confirmed that fossil avtur and SAF that does not meet the sustainability criteria will be subject to the obligation. It is **proposed that the supply of fossil aviation fuels other than avtur will not be subject to an obligation.**

This means that fossil aviation gasoline (avgas), hydrogen and ammonia will not incur any obligation. Sustainable fuel alternatives for aircraft using these fuels are not as technically mature as those for avtur so applying an obligation at this stage would be overly burdensome on industry. However, we will keep this position under review.

Fuels eligible for certificate reward

We are proposing that the supply of SAF used in UK aviation that meets the sustainability criteria will be eligible for certificates. As set out in the government response to the consultation eligible SAF includes biofuels derived from wastes and residues, RCFs and PtL. Each of these SAF types can produce drop-in avtur.

As set out in [Chapter 5](#) most SAF (i.e. biofuels and RCFs) will be awarded 'standard certificates' - these are required to be redeemed to the Administrator at the end of the obligation period as evidence of meeting the standard SAF obligation.

PtL fuels will be eligible for 'PtL certificates' which are required to be redeemed to the Administrator at the end of the obligation period as evidence of meeting the standard SAF obligation.

In addition to avtur, biofuels derived from wastes and residues, RCFs and PtL can produce other types of low-carbon aviation fuel.

We are now proposing that the following aviation fuels will also be eligible for standard certificates:

- **low carbon hydrogen;**
- **low carbon unleaded avgas; and**
- **low carbon ammonia.**

Including these alternative fuels as eligible for receiving certificates under the mandate could accelerate their development, creating additional revenue streams for suppliers and improving the business case.

In order for the supply of all of the aforementioned aviation fuels to be eligible for certificates, the sustainability criteria set out in this chapter will have to be met. For example, the SAF will need to be derived from eligible feedstocks and the fuel must meet the minimum carbon intensity reduction on a lifecycle basis.

To ensure that all aviation fuels are covered by one policy, **we propose that no SAF will be eligible for support under the RTFO once the mandate is in place.**

Technical criteria

We previously confirmed that, when replacing avtur, only certified SAF that meets the Ministry of Defence (MOD) Defence Standard (DEF STAN) 91-091 and American Society for Testing and Materials (ASTM) D7566 specification will be eligible for incentives under the SAF mandate **and** count towards the mandate obligation. ASTM specification is recognised as the global SAF standard and includes a list of SAF production pathways that are approved. These can be dropped into fossil jet fuel, up to certain maximum blend levels to ensure the blend performs as safely as conventional fuel.

The MOD DEF STAN 91-090 is a globally recognised avgas standard and one of the most commonly used avgas fuel standards. **We propose that SAF alternatives to avgas (low carbon avgas) must meet the DEF STAN 91-090 specification in order to be eligible for support.** Unlike DEF STAN 91-091 used for avtur, there are no articles prescribing specific production pathways or blending limits for low carbon avgas. However, as low carbon avgas becomes commercialised and more data is available, we anticipate that the standards will be revised to include specific provisions on low carbon drop-in alternatives.

For hydrogen and ammonia, the fuel standards for aviation are still under development.

Once relevant standards for new SAF pathways have been developed, we propose that we will amend the SAF mandate legislation fuel definitions to include them.

CONSULTATION QUESTIONS

Q17: Do you agree or disagree that low carbon avgas, low carbon ammonia and low carbon hydrogen aviation fuel, should be eligible for incentives without being subject to obligation providing they meet the sustainability criteria?

Q18: Do you agree or disagree that the definition of aviation fuels should include relevant technical specifications?

Definitions of fuels

HEFA

It is critical that HEFA is clearly defined so that suppliers are clear which fuel are subject to the HEFA cap. **We propose that the HEFA cap applies to any fuel using a segregated oil or fat as a feedstock**, where a segregated oil or fat is defined as “a material that is capable of being used as a transport fuel directly, after extraction, or after conversion by transesterification, into a usable fuel, irrespective of any blend wall limits on use”. This definition includes:

- waste vegetable oils, fish oils and animal fats (tallow and greases); and
- segregated or mixes of free fatty acid, fatty acid esters and any derivative thereof.

The HEFA cap will therefore not apply to waste or residue-derived materials that require significant upgrading (via thermochemical or catalytic cracking) in order to produce fuels. This includes, for example, tyre pyrolysis oil.

Note that the ASTM standard described in the previous section defines HEFA as the process of hydroprocessing of oils or fats to produce kerosene.

By linking the HEFA cap to the feedstock, rather than the pathway as currently set out in the ASTM standard, we are able to cap those feedstocks that currently play a significant role in renewable road transport fuel without curtailing the use of novel feedstocks adopting a similar production process. The definition will be legislated for, with further information of how it is applied in guidance and examples of specific feedstocks published on the gov.uk website.

CONSULTATION QUESTION

Q19: Do you agree or disagree with the proposed definition of HEFA? If not, please provide an alternative definition.

Power to liquid fuels

We propose the fuel eligible for PtL certificates is low carbon avtur for which the energy content of the fuel is derived from renewable (excluding bioenergy) or nuclear energy sources. Fuels produced using fossil energy would not be eligible.

As the available energy source of PtL fuels comes from electricity derived from renewable or nuclear sources, the input raw materials must contain no usable energy. In practice this means that PtL fuels will be made from water (as the source of hydrogen) and CO₂ (as the source of carbon). We propose that CO₂ can be derived from atmospheric or naturally-

occurring/geothermal sources, biological sources or from fossil sources (for example, waste flue gases from coal and natural gas power generation). This will allow a wide range of waste CO₂ sources to be exploited, particularly where emitters do not have access to the CO₂ transport and storage network. We note that gaseous fuels are excluded from the Waste Framework Directive⁸. As such the requirement in our legislation will be that the input CO₂ has not been deliberately produced for the sole purpose of creating a fuel.

Where carbon sources other than CO₂ are used in the production process, energy would be imparted on the final fuel and therefore the resultant fuel would not be considered a PtL. For example, carbon monoxide (typically generated where incomplete combustion has occurred) contains energy – so if carbon monoxide from combustion of biomass was used the resultant fuel would be a biofuel, while using carbon monoxide from a waste fossil gas would be classed as an RCF. To ensure that an accurate proportion of the resulting fuel is correctly assigned as PtL, RCF or biofuel, it will be necessary to carry out energy allocation practices. We will publish guidance on this ahead of the introduction of the mandate.

CONSULTATION QUESTION

Q20: Do you agree or disagree with the proposed definition of fuels that will be eligible for PtL certificates to be redeemed against the PtL obligation?

Waste assessment

We previously confirmed that only waste and residue feedstocks will be eligible SAF feedstocks; food, feed and energy crops will not be. Therefore, it is necessary to conduct a waste assessment at feedstock level to determine whether the feedstock is eligible for support under the SAF mandate. The following definitions will apply:

- 'waste' means any substance or object which the holder discards or intends or is required to discard. This definition excludes substances that have been intentionally modified or contaminated for the purpose of transforming it into a waste.
- 'residues from agriculture, aquaculture, fisheries or forestry' means residues that are directly generated by agriculture, aquaculture, fisheries or forestry; they do not include residues from related industries or processing.
- 'processing residue', in relation to a production process, means a substance that is not the end product sought directly from the process; the production of which is not a primary aim of the process; and in respect of which the process has not been deliberately modified in order to produce it.

In the Government response to the first SAF consultation we made a commitment to adopt the same waste assessment framework developed under the RTFO 2007 given this has undergone rigorous testing and been used in practice for many years. That is, the Administrator will first consider whether the material meets the definition of a waste or residue. Following this, the Administrator will consider the feedstock implications on factors⁹ set out in the Energy Act 2004 to determine whether the feedstock is eligible. Only those feedstocks that do not produce negative effects on these factors will be eligible for support

⁸ <https://www.gov.uk/government/publications/legal-definition-of-waste-guidance/definition-of-waste-2018-waste-framework-directive-amendments>

⁹ Carbon emissions; agriculture; other economic activities; sustainable development; the environment generally

under the mandate – this is the equivalent process for determining wastes and residues that receive two certificates in the RTFO (double the standard level of support which crop derived biofuels are eligible for under that scheme).

There are no further changes proposed to the policy set out, and therefore we are not consulting further on the waste assessment.

We will provide a comprehensive overview of the waste assessment framework in guidance that will be published ahead of the mandate starting in 2025. We anticipate the guidance will follow the current RTFO guidance closely, which is currently set out in Chapter 4 of the RTFO Compliance Document¹⁰.

Land criteria

We confirmed in the government response to the first SAF mandate consultation that biofuels derived from agricultural wastes and residues will be subject to land criteria and soil carbon criteria; and biofuels derived from forestry wastes and residues will be subject to the forestry criteria. This is to ensure any land use impacts resulting from the harvesting of the principal crop and/or collection of the resultant waste are appropriately managed.

We confirmed that the SAF mandate will adopt the same criteria as prescribed in the RTFO currently. The soil carbon criteria, land criteria and forest criteria are legislated for in Schedule 1, Schedule 2 and Schedule 3 of the RTFO Order, respectively.

Further information on demonstrating compliance with these criteria is set out in [Chapter 6](#), which will also be explained in detail in guidance published ahead of the mandate starting.

Electricity criteria

In the government response to the first mandate consultation, we noted our intention to implement consistent rules concerning the use of renewable fuels of non-biological origin (RFNBOs) as the RTFO. That is, where renewable or nuclear electricity contributes to the energy content of SAF, the default position is assumed to be that electricity is derived from the grid. In this case:

- the proportion of the resultant fuel that is deemed to be an eligible PtL fuel is equal to the proportion of the grid that is derived from renewable (excluding biomass) and nuclear sources. For instance, if grid energy is powered by 40% renewable or nuclear sources, only 40% of the resulting fuel's energy will be eligible under the mandate; and
- the carbon intensity of the electricity consumed is equal to the annual national average carbon intensity¹¹.

¹⁰ <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-rtfo-compliance-reporting-and-verification>

¹¹ Once data is available to sufficient quality, real-time grid averages will be accepted.

The exceptions to this are if a production site is connected to an electricity grid that meets the criteria for regionality¹², when regional grid averages can be used, or if the renewable or nuclear electricity is considered additional.

Additionality, as defined in the RTFO, is renewable (or nuclear) energy that would not have been available to the grid in the absence of power demand from the RFNBO plant in question. These rules are in place to ensure that the production of RFNBOs does not divert energy from existing power applications, which would likely be replaced with some fossil energy sources leading to increased GHG emissions. The government proposes to uphold the same values in the mandate to ensure that fuels deliver genuine GHG savings.

In July 2021, the Department published a government response to a consultation on amendments to the RTFO¹³ followed by updated guidance on RFNBOs¹⁴ introducing a wider scope of compliance options to RFNBO producers. The revised guidance opens up different pathways to either prove the renewable electricity used for production complied with the additionality principles, or that regional grids could be considered when assessing the overall GHG intensity of the electricity. The benefits of additional energy will be extended to biofuels and RCFs when introduced into the RTFO.

We propose that the SAF mandate adopts the same criteria on the use of energy, including additionality, as the RTFO for PtL, biofuels and RCFs. These rules were introduced to maximise flexibility and cost effectiveness for suppliers, while still aligning with the requirements of the Energy Act. Given we intend to implement the mandate using the powers contained within the Energy Act, this requires that the whole economy decarbonisation and sustainability impacts of the fuel are considered, not just the exhaust emissions or immediate supply chain. Therefore, it would not be possible to introduce less stringent rules. Furthermore, aligning with the RTFO facilitates the compliance for suppliers operating under both the SAF mandate and RTFO.

The scope under the Energy Act and consequent additionality rules would also carry across to SAF derived from nuclear energy. Given nuclear energy is not yet supported under the RTFO, detailed rules on the guiding principles and how suppliers comply with these does not exist in UK policy. We propose the guiding principles will align with those for renewable energy, while the details on compliance will be set out later in guidance following engagement with industry. Amendments have been laid in parliament to enable the support of nuclear derived fuels (NDFs) flowing from the Energy Act.

CONSULTATION QUESTIONS

Q21: Do you agree or disagree that the SAF mandate should adopt the criteria concerning additionality for RFNBOs that aligns with the RTFO?

¹² If the electricity grid a production site is connected to can be reasonably considered to be a distinct electricity grid from the relevant national grid, suppliers may use data from that electricity grid rather than the national grid in determining the portion of their fuel which is defined as a PtL

¹³ <https://www.gov.uk/government/consultations/amending-the-renewable-transport-fuels-obligation-rtfo-to-increase-carbon-savings-on-land-air-and-at-sea>

¹⁴ <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-rtfo-compliance-reporting-and-verification>

Q22: Do you agree or disagree that additionality rules should be introduced for nuclear power that follow the same principles as those currently applied to RFNBOs in the RTFO?

Use of hydrogen in SAF production

Hydrogen is typically used in SAF production in two ways:

- as a process input – where hydrogen is typically used for removing impurities, such as sulphur, oxygen and nitrogen, but does not contribute to the final hydrocarbon fuel; or
- as a feedstock – where hydrogen contributes to the final energy content of the fuel, this includes processes such as hydrosaturation and hydrocracking which add hydrogen to the hydrocarbon chain and thereby increase the energy of the resultant fuel.

In the government response published in July 2022, we confirmed that where hydrogen is used as a *feedstock*, it must be low carbon. Where hydrogen is used as a *process input*, no further eligibility criteria will apply beyond the final fuel meeting the minimum GHG saving threshold.

Where hydrogen is used as a feedstock, we propose that the hydrogen must be low carbon. This includes renewable or nuclear electrolytic hydrogen, biohydrogen from wastes or residues and RCF hydrogen. This proposal is in line with our wider feedstock eligibility criteria and will ensure that the mandate delivers the most sustainable fuels.

If eligible hydrogen is used as a feedstock, the energy from that hydrogen contributes to the final fuel and the final fuel is eligible for support in the form of a certificate. As explained previously, where renewable or nuclear electrolytic hydrogen is combined with waste CO₂, the resulting fuel will be eligible for PtL certificates. Hydrogen is also an important feedstock in other production pathways. Where eligible hydrogen is used for production pathways other than PtL, the resulting fuel will be eligible for standard certificates.

If the hydrogen used is not low carbon, the SAF is unlikely to meet the minimum GHG savings threshold and would not be eligible for support. If a low carbon but ineligible source of hydrogen was used the resulting fuel could meet the minimum GHG savings threshold but would be a partial-SAF so would receive certificates in proportion to the energy resulting from eligible feedstocks.

Analysis shows that in 2030, SAF production could need 0.6-3TWh of low carbon hydrogen, increasing to 5-20TWh by 2040 depending on final mandate targets. The UK Hydrogen Strategy set out the government's intention to develop multiple low carbon hydrogen production technologies, including both water electrolysis ('green hydrogen', powered by low carbon electricity) and CCUS-enabled methane reformation ('blue hydrogen') and that these would likely make up the bulk of production capacity in the 2020s. The British Energy Security Strategy doubled the UK's ambition to up to 10GW of low carbon hydrogen production capacity by 2030, subject to affordability and value for money, with at least half of this coming from electrolytic hydrogen. Since then the government has launched the UK Low Carbon Hydrogen Standard (LCHS) to define low carbon hydrogen for the purposes of

production facilities seeking support under the Net Zero Hydrogen Fund and Hydrogen Production Business Model.

Analysis by government and the Climate Change Committee has previously indicated methane reformation with CCUS to have among the lowest levelized costs of all low carbon hydrogen production routes. Analysis informing development of the LCHS indicates hydrogen plants seeking to employ efficient methane reformation with carbon capture and storage can meet the standard but highlighted the importance of ensuring high carbon dioxide capture rates and addressing fugitive methane emission during natural gas extraction and transport.

However, the SAF mandate cannot support blue hydrogen without primary legislation amendments. Alongside this, while CCUS enabled methane reformation can produce low carbon hydrogen and is expected to play a key role in growing the hydrogen economy, there will always be some level of emissions associated with the production process, whereas electrolysis can be zero emission (subject to the electricity used). Evidence also suggests that electrolysis shows the greatest potential for long term cost reduction.

We therefore welcome respondents to provide evidence on the use of blue hydrogen in SAF production to understand in greater detail whether we should take appropriate legislative action to include blue hydrogen as a feedstock in our eligibility criteria. Specifically, we welcome views from SAF producers on how the eligibility of blue hydrogen would impact plants' operation and business case:

- existing industry plans to use blue hydrogen in SAF production;
- how the capital and operational costs of blue hydrogen compares to proposed eligible hydrogen production routes and the impact this would have on the price of SAF;
- how the use of blue hydrogen versus proposed eligible hydrogen production routes will impact production capacity and whether eligibility of blue hydrogen is required to meet UK SAF targets; and
- how the use of blue hydrogen versus proposed eligible hydrogen production routes will impact lifecycle carbon intensity of resultant SAF.

Hydroprocessing in the SAF mandate

The distinction between a process input and feedstock is not always definitive. During the fuel upgrading process, fuels undergo hydroprocessing which often uses fossil hydrogen (as a process input) to remove impurities. However, in some cases, the hydrogen can also contribute atoms to the hydrocarbon and increase the final energy content of the fuel. This includes processes such as hydrotreating and hydrocracking.

In these uncertain cases, current practice under RTFO requires that analytical approaches are applied to determine the extent to which a hydrotreating step increases the hydrogen content of the finished fuel.

In the context of SAF, most pathways require hydrogen for fuel upgrading to some degree¹⁵. The amount of hydrogen used in upgrading depends on pathway, level of impurities and

¹⁵ [Waste-to-products-technology-and-economic-assessment-phase-1.pdf \(concawe.eu\)](https://www.concawe.eu/publications/waste-to-products-technology-and-economic-assessment-phase-1.pdf)

final product preference, but potentially a significant amount of final energy content of fuel may come from hydrogen used in the refining process¹⁶.

In light of this, an approach whereby specific SAF pathways are treated differently to others may create an unfair advantage. We are therefore minded to require all suppliers to determine the amount of hydrogen in the hydroprocessing step that contributes both atoms and energy of the fuel, unless eligible low carbon hydrogen is used. This approach will ensure that no fossil hydrogen is rewarded under the mandate and that emissions savings achieved are calculated accurately. We recognise that this will introduce additional administrative burden for suppliers and by extension voluntary schemes. Therefore, we will work closely with voluntary schemes to determine how best to demonstrate evidence, as well as taking into account the approach adopted in the EU on this matter.

CONSULTATION QUESTIONS

Q23: Do you agree or disagree that, where hydrogen is used as a feedstock, eligibility should be limited to biohydrogen derived from wastes or residues, RCF hydrogen and electrolytic hydrogen derived from renewable and nuclear power (when legal powers allow)?

Q24: Do you agree or disagree that the contribution of energy content from hydroprocessing should be calculated?

CALL FOR EVIDENCE

4. The Department would welcome evidence on the use of blue hydrogen in SAF production:

- Existing industry plans to use blue hydrogen in SAF production
- How the capital and operational costs of blue hydrogen compares to proposed eligible hydrogen production routes and the impact this would have on the price of SAF
- How the use of blue hydrogen versus proposed eligible hydrogen production routes will impact production capacity and whether eligibility of blue hydrogen is required to meet UK SAF targets
- How the use of blue hydrogen versus proposed eligible hydrogen production routes will impact lifecycle carbon intensity of resultant SAF

Minimum carbon intensity reduction

We previously confirmed that SAF would need to achieve a minimum carbon intensity reduction compared to fossil derived kerosene in order to be eligible for certificates under the mandate. Although our scheme will already incentivise SAF with the lowest carbon intensity, this mechanism will provide added assurance that the mandate obligation cannot

¹⁶ This figure refers to hydrogen used in the hydroprocessing steps during the refining step. The actual energy content of resultant fuel that is derived from hydrogen atoms may be much higher than this if hydrogen is used a feedstock used earlier in the production process, for example during gasification processes.

be met with high carbon intensity SAF. In the government response to the first mandate consultation, we suggested that a 50% carbon intensity reduction compared to fossil kerosene (maximum carbon intensity of 44.5 gCO₂e/MJ) should be introduced for all fuel types because:

- it aligns with the proposed minimum carbon intensity reduction of RCFs in the RTFO, addressing a key ask from industry to align with an existing scheme;
- it considers feedback from industry to allow for the development of emerging technologies and will encourage plant developers to locate in the UK; and
- a common threshold across all types of SAF production pathways ensures a level playing field.

We want to ensure that setting a minimum carbon intensity reduction does not unnecessarily exclude certain types of fuels or feedstocks that could still achieve significant GHG emissions savings compared to fossil kerosene. Specifically, some SAF production may not meet the minimum threshold during the initial years of production. However, it is expected that the carbon intensity of SAF will decrease over time through the decarbonisation of the electricity grid and supply chains, as well as the optimisation of production processes and the adoption of CCS in reducing emissions of some of the SAF pathways.

If we set the minimum carbon intensity reduction threshold too high, it could risk stifling innovation and reducing investment into SAF. This could minimise the diversity of the SAF pool and limit the volumes of SAF brought to the UK market, or that is produced in the UK, that could help to meet the mandate. Therefore, we are minded to introduce a less stringent minimum carbon intensity reduction threshold. This would loosen obligations on fuel suppliers in the short term, in order to mitigate the risk of SAF plant development being slowed down due to stringent sustainability criteria.

We welcome views and supporting evidence on which of the following minimum carbon intensity reductions are appropriate to allow a wide range of SAF technologies to develop, while also maintaining high sustainability credentials:

- 40% saving compared to fossil kerosene (equal to a maximum carbon intensity of 53.4 gCO₂e/MJ)
- 50% saving compared to fossil kerosene (equal to a maximum carbon intensity of 44.5 gCO₂e/MJ)
- 60% saving compared to fossil kerosene (equal to a maximum carbon intensity of 35.6 gCO₂e/MJ).

Depending on the fuel type, the minimum carbon intensity reduction set out in the RTFO ranges from approximately 50-70%¹⁷. To accelerate the decrease in carbon intensity across all SAF production pathways, the minimum carbon intensity reduction that SAF must achieve to qualify for the mandate could be raised over time. Although it is expected that the mandate will provide a strong incentive for suppliers to reduce the carbon intensity, changing the minimum carbon intensity reduction may be necessary if it is initially set at a less stringent level. Therefore, **we propose that the threshold will be increased over time.**

¹⁷ The RTFO uses a fossil fuel comparator of 94 gCO₂e/MJ.

We recognise, however, that increasing the threshold could exclude certain SAF production facilities over time, such as those that are unable to incorporate CCS or those located in international regions with delays in decarbonising the electricity grid. Furthermore, the rate at which the threshold increase will be dependent on the level at which it is initially introduced. For example, should a tighter threshold of 60% be introduced from 2025, there will be less need to increase this. We will therefore continue to monitor external factors, such as grid intensity and CCS transport and storage network development, as well as deciding on the initial threshold before setting out how this will evolve over time. However, we invite views from stakeholders on increasing the threshold at this stage.

CONSULTATION QUESTIONS

Q25: What level should the maximum carbon intensity threshold be set to maintain high sustainability credentials while ensuring enough flexibility to allow a wide range of SAF to be developed? Please provide evidence to support your answer.

Q26: Do you agree or disagree that the minimum carbon intensity reduction should be increased over time? If so, how should it evolve?

GHG emissions calculation methodology

Fuel suppliers must be able to demonstrate that the carbon intensity of their supplied SAF achieves the minimum carbon intensity saving threshold in order to determine the number of certificates to be rewarded. In the government response published in July 2022, we set out that we were minded to adopt the same GHG methodologies as used in the RTFO. These methodologies measure the direct GHG impacts (including CO₂, CH₄ and NO₂) of fuel production through an attributional life-cycle analysis approach covering cultivation, fuel processing and/or transport. For biofuels and RFNBOs, the methodologies are set out in guidance¹⁸, while the RCF methodology was consulted on in July 2022 and will be confirmed in an upcoming government response.

The Department for Transport recently commissioned NNFCC¹⁹ to explore whether revisions to the RTFO GHG emissions calculation methodology would be necessary to accurately reflect the lifecycle emissions of SAF. The final report confirmed that the general RTFO approach to GHG assessment for biofuels, RCFs and RFNBOs would be applicable to SAF. **We therefore propose that the existing RTFO methodologies for biofuels, RFNBOs and RCFs will be adopted for the SAF mandate.**

Nuclear derived fuels are not currently permitted in the RTFO, though they are produced in the same way as RFNBOs but with a different energy source. For nuclear derived SAF, **we propose to adopt a GHG methodology that follows the same principles as the RFNBO methodology.**

Adopting these methodologies will create homogeneity between the mandate and the RTFO, as well as international SAF policy. The UK biofuels methodology is based on the same overarching methodology employed by the EU. The RFNBO and RCF methodologies have been developed by the UK, though the EU are developing similar methodologies using the

¹⁸ <https://www.gov.uk/government/publications/renewable-transport-fuel-obligation-rtfo-compliance-reporting-and-verification>

¹⁹ National Non-Food Crop Centre

UK methodology as a template. Although CORSIA adopts a similar approach for deriving core values, it also permits a range of additional indirect GHG factors that reduce the carbon intensity of fuels (for example waste displacement from landfill or improved recycling), resulting in different values for the same fuel declared under the UK mandate and these schemes.

CONSULTATION QUESTIONS

Q27: Do you agree or disagree that the GHG methodologies used in the RTFO should be adopted in the SAF mandate?

The use of default and actual values

Under the existing RTFO and EU Renewable Energy Directive (RED) methodologies, default values are provided for either a complete process pathway (total default value) or specific lifecycle analysis elements (disaggregated default value e.g. for the production stage or transport elements of the pathway) as an alternative to reporting actual GHG values for biofuels²⁰. These provide a means for suppliers to submit a carbon intensity value of its fuel where certain GHG values are not easily measurable or without the need for a detailed understanding of the GHG requirements. Default values have been developed to be conservative, encouraging adoption of use and reporting of actual values. Given that the SAF mandate will reward certificates in proportion to carbon intensity of SAF supplied, it is critical that default values do not understate the carbon intensity of the fuel.

The Joint Research Centre²¹ determine the default values for EU RED, which are also adopted in the RTFO. The process is resource intensive and consists of a comprehensive review of literature on the GHG impacts of each process pathway at a granular level, in order to keep up with the latest science and evidence. Information available on SAF GHG values is limited in comparison to renewable road transport fuel given that most SAF production plants are at an early demonstration phase, leading to difficulties in determining default values.

Determining GHG values using estimations, modelling or old data can lead to uncertainties or inaccuracies. CORSIA provides total default values using this approach, which attribute significant GHG savings for many SAF pathways. In some cases, where the GHG emissions do not relate directly to the SAF production process employed, for example downstream transport and distribution emissions, default values have more widely accepted assumptions.

We propose that disaggregated default values will be provided for downstream emissions where data or robust assumptions are readily available. However, total default values will not be provided. Where default values are provided, suppliers will still hold the right to use and report actual values. This means that actual values will have to be used and reported for the processing of feedstocks into fuel. In line with current practice, we plan for the default values to be an intentionally conservative estimate. We will set out the default values in guidance published ahead of the mandate starting in 2025.

²⁰ The RTFO methodologies for RFNBOs and RCFs do not currently include default values.

²¹ The Joint Research Centre offers scientific expertise to support EU policy areas. This includes the Renewable Energy Directive, for which they are tasked with determining default values.

SAF developers should already have some form of GHG assessment or projection in place, likely with input from voluntary schemes (see [Chapter 6](#) for further information), as this is necessary for any plant seeking investment. Therefore, we envisage that many of these figures that input into the lifecycle analysis will be readily available. However, we welcome views on whether collecting actual values for any part of the lifecycle will introduce challenges for suppliers. Following the commencement of the mandate, we will collate evidence on the lifecycle emissions of SAF and consider introducing total default values and/or further disaggregated default values in the future.

The Department considers renewable power to be zero emissions at point of delivery if proven to be additional, otherwise grid average emissions are used. With additional nuclear energy, ongoing upstream and operational activities, such as processing and transport, have GHG emissions associated with them and should be accounted for in the methodology. We propose that suppliers provide a GHG value for the upstream and operational emissions, either as an actual value or default value provided by DfT. This includes activities such as nuclear fuel extraction, processing, reprocessing and disposal.

The GHG emissions attributed to such activities range in literature from around 1.7-1.9 gCO₂/MJ, based on an assessment of current facilities²²²³. It may be necessary to apply a conservative factor to these figures to ensure the carbon intensity is not understated. We welcome views and further evidence on what an appropriate default value is.

CONSULTATION QUESTIONS

Q28: Do you agree or disagree that only disaggregated default values will be provided for downstream emissions while the rest of the SAF lifecycle will require the use of actual GHG values?

Q29: Please provide evidence to inform which default values should be provided by DfT for downstream emissions.

Q30: Do you agree or disagree that upstream and operational emissions should be included for nuclear power generation at the point of delivery? If yes, please provide evidence of what figure could be used for the default value.

Non-CO₂

The proposed GHG methodology focuses on accounting for CO₂, CH₄ and NO₂ emissions. However, we recognise that aviation fuels, and indeed fuels more generally have environmental impacts which extend beyond these emissions. Some studies suggest that non-CO₂ emissions account for over half of the climate impacts from aviation²⁴.

Research and analysis carried out so far suggests that SAF is expected to have a positive impact on reducing non-CO₂ impacts. For example, research conducted by the National Aeronautics and Space Administration (NASA) and the German Aerospace Centre (DLR)

²² [life cycle assessment of electricity from sizewell b nuclear power plant development.pdf](#) (edfenergy.com)

²³ [life cycle assessment of electricity from torness nuclear power plant development.pdf](#) (edfenergy.com)

²⁴ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/813342/non-CO2-effects-report.pdf

showed that SAF can produce 50%-70% fewer soot particles, which could reduce the warming impact of contrails.²⁵

Nevertheless, significant uncertainties surrounding the climate impact of non-CO2 emissions and non-CO2 benefits of SAF remain, and there is currently no scientific consensus over a suitable metric for comparing the climate effect of CO2 with non-CO2 impacts, or for effective monitoring of non-CO2 impacts. This is a barrier to developing credible mitigation measures, which is why the Jet Zero Strategy included a commitment to address these impacts by improving our understanding. We anticipate that scientific uncertainties will reduce as new evidence emerges.

An initiative that will contribute to our understanding of how SAF can mitigate non-CO2 impacts is the Net Zero Transatlantic Flight Fund which is supporting industry in achieving the first transatlantic flight on an aircraft using 100% SAF. This project is expected to be carried out later this year and will use tailpipe emission monitoring technology to evaluate the effects of particles and contrails at cruise altitude and monitor benefits to local air quality around airports. Moreover, we committed in the Jet Zero Strategy to carefully consider any need for additional research activity on non-CO2 including working with UKRI.

Given the lack of certainty in this field, government is not in a position to develop mitigation measures. As new evidence emerges from the initiatives discussed here, as well as wider scientific and technological efforts, we will review the latest information and consider whether, and how, non-CO2 impacts are treated under the SAF mandate.

²⁵ NASA Press Release: NASA-DLR Study Finds Sustainable Aviation Fuel Can Reduce Contrails:
<https://www.nasa.gov/press-release/nasa-dlr-study-finds-sustainable-aviation-fuel-can-reduce-contrails>

4. Involved parties

In the government response, we confirmed that the obligation would fall on suppliers of avtur to the UK aviation market. This chapter sets out how the supplier is defined through the assessment point, as well as which fuel will be subject to an obligation. In addition to obligated suppliers, this chapter also sets out the roles and responsibilities of those involved in administering the mandate.

The Administrator

We propose that the SAF mandate will be administered by a specific body (the Administrator) that will be responsible for enforcing the scheme and supporting fuel suppliers to comply.

The Administrator will act as the regulator of the scheme, ensuring compliance with the SAF mandate legislation. It will identify, establish and maintain accounts of those suppliers that have an obligation and ensure that fuel rewarded under the scheme meets sustainability requirements. In line with the RTFO and the Energy Act 2004, we propose the Administrator is granted the following powers and duties:

- identify suppliers that are expected to be obligated, promote good working relationships with obligated parties and publicise the obligation appropriately;
- establish, maintain and close accounts in which the balance of certificates are recorded, as well as other matters, for obligated suppliers and those that intend to trade certificates;
- request, record and retain information from obligated suppliers or other relevant parties to support the functions of the Administrator;
- publish guidance for obligated parties and independent verifiers that explains the detailed sustainability information and GHG methodology and how suppliers are expected to comply with such requirements;
- establish processes for the application, issuing and transfer of certificates and record changes in certificates in suppliers' accounts;
- revocation of certificates;
- notify suppliers of their obligations, ensure that suppliers' obligations are wholly discharged and, in the case where they are not wholly discharged, ensure the supplier pays the buy-out sum;
- issue civil penalties and handle objections; and
- publish reports related to the SAF mandate.

The powers and duties set out above are consistent with those of the RTFO Administrator as described in the RTFO Order and RTFO guidance. The proposed powers for the SAF mandate Administrator are covered in more detail in this consultation at **Chapter 6** and **Chapter 7**.

Under the RTFO, the Administrator is the Secretary of State for Transport, who delegates responsibility to an administrative unit within the Department for Transport. **We propose that the same approach is adopted in the SAF mandate.**

CONSULTATION QUESTIONS

Q31: Do you agree or disagree that the Secretary of State should be the Administrator, with responsibility delegated to a DfT administration unit?

Q32: Are there any additional powers or duties beyond those outlined above that the Administrator should be granted?

Obligated parties and obligated fuel

We confirmed that suppliers of fossil jet fuel to the UK will be subject to an obligation, where the supplier is defined as the owner of the fuel at the assessment time, which is described in further detail below.

We do not propose to introduce a requirement on the percentage of SAF in the aircraft, and in practice it is expected that the mandate will be met completely by blended fuels in the early years. Currently, none of the technical fuel standards allow for 100% blends to be used in commercial operations (see [Chapter 3](#) for further information on fuel standards). However, ongoing efforts between industry and standardisation bodies aim to increase the blending limit of fuel specifications.

Definition of assessment time

The term ‘assessment time’ refers to the point in the supply chain where fuels are deemed as obligated or eligible for reward under the mandate scheme. The owner of the fuel at this point will either be obligated under the mandate and/or be eligible to claim mandate certificates, depending on the type of fuel they are supplying.

The assessment time acts as a control point for the scheme to avoid obligating (or rewarding in the case of SAF) the same fuel more than once. Having a single control point minimises administrative burden and avoids risk of fraud. It should therefore be clearly defined and occur just once along the supply chain. This will also provide certainty to suppliers and ensure that the scheme can be effectively administered.

Government response on assessment time for avtur

In the government response to our first mandate consultation, we stated that the government was minded to place the assessment time at the blending and certification point, which was favoured by a majority of respondents. The reasons for choosing this point were that:

- the blending and certification point aligns with the assessment time for avtur under the RTFO²⁶;
- the blending and certification point is where the fuel would be certified to meet DEF STAN 91-91 and a refinery certificate of quality would be issued to show the fuel is fit for use in aviation; and
- the supplier generally owns the fuel at this point.

Since publishing the government response, this assessment time has been considered further, including through discussions with suppliers and other industry stakeholders at the Jet Zero Council SAF Delivery Group Mandate Subgroup. The latest evidence indicates that the blending and certification point would not work in practice as an assessment time under the mandate because:

- **Fossil jet fuel (fossil avtur) is not always blended and certified.** We need to ensure fossil avtur is consistently captured under the mandate, as suppliers of this fuel will be the obligated party. Using this as the assessment time would mean having a different assessment time for fossil avtur than SAF to ensure we capture it all, which is not desirable for the reasons set out above. The blending and certification point works as an assessment time under the RTFO because fossil avtur is not obligated but SAF is still rewarded.
- **SAF may be blended outside the country and imported pre-blended.** This means that the assessment time would be outside of the UK. This requires an onward chain of custody to be established from the blending and certification point to the point of use in UK transport, which experience with the supply of SAF under the RTFO has proved administratively complex for suppliers.
- **Blending does not necessarily happen at a defined point in the chain.** This could happen at multiple points before the airport storage depot or before it is dispensed into any conventional jet supply chains e.g. conventional jet pipelines.

The above points highlight that if the blending and certification point was used as the mandate assessment time, it could happen in at least three different points within the supply chain. This would leave considerable room for uncertainty for suppliers and the administrator, making it difficult to determine who is the obligated party and the size of their obligation.

Alternative options considered

As a result of the issues with our original proposed assessment time, we carried out further analysis, re-reviewed consultation responses and engaged with fuel suppliers to map out the avtur supply chain (a simplified version is shown in Figure 16 below) to find alternative assessment times. These were narrowed down to two options, which are discussed below.

²⁶ In the 2016 RTFO consultation an alternative assessment time for avtur was suggested as most avtur is not dutiable.

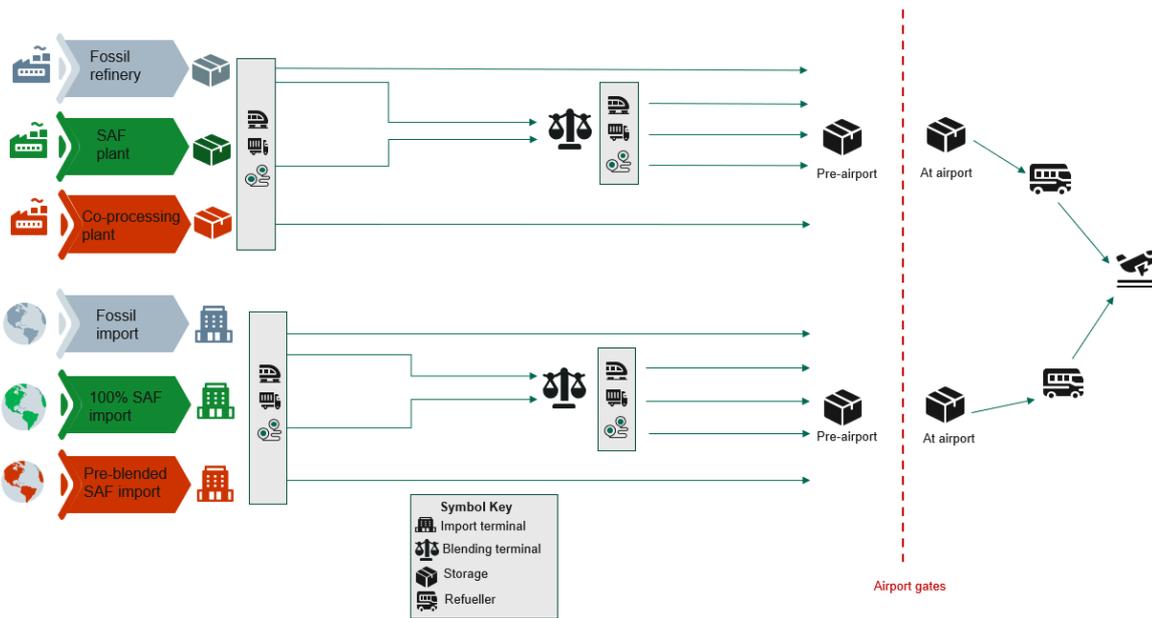


Figure 16: Avtur supply chain

Last recertification point or point of delivery to airport

Some stakeholders suggested either the last recertification point of the fuel or the point of delivery to the airport as the assessment time, as these would likely be located where the fuel could be proven for use in aviation. This would mean that suppliers would not need to demonstrate a detailed onwards chain of custody past the production plant.

However, as there are multiple recertification points for jet fuel along the supply chain, rather than one static recertification point, and multiple ways in which fuel can reach an airport, there is no definitive way for certifiers to know which recertification point is the last. Similarly, for the point of delivery to the airport, fuel is delivered to airports in a number of different ways, including through pipelines, which means tracking the exact point when it enters the airport could be difficult. Additionally, the fuel may no longer be owned by suppliers at this point, which means that a party other than the supplier could be obligated.

Duty point equivalent

One stakeholder suggested setting the assessment time at the duty point for avtur (which would cover both fossil avtur and SAF). Although avtur is fully rebated (no duty is paid), it is still a controlled oil as defined in section 27 (1) of The Hydrocarbon Oil Duties Act 1979 (HODA)²⁷ and has a duty point. This would align with the current assessment time for road fuels under the RTFO, making it administratively easier for suppliers of fuels to both the road and aviation markets.

Avtur, like other controlled oils, becomes liable for duty when it is:

- imported;

²⁷ <https://www.legislation.gov.uk/ukpga/1979/5/contents>

- produced in the UK and delivered for home use from relevant premises; or
- when it leaves a tax warehouse for use in a relevant mode.

Note, when a controlled oil (i.e. avtur or SAF) is produced at, or imported into, a tax warehouse (e.g. a refinery), it is duty suspended and only becomes liable for duty when it leaves the warehouse for use in a relevant mode. This is normally when the duty point occurs.

Handlers of unmarked, rebated avtur are required to follow strict HMRC guidance²⁸ which requires dealers in avtur to keep good records, including on quantities delivered. This means that evidence of fuel volumes at this point of the supply chain would be readily auditable. Dealers and handlers of avtur must also be approved by HMRC.

New proposed assessment time for avtur

We are proposing that the assessment time for avtur under the SAF mandate is at the duty point for the reasons set out above.

We are conscious that there could be specific supply chains for which this assessment time does not work. **We welcome evidence of circumstances in which this proposed assessment time could cause compliance challenges.**

CONSULTATION QUESTION

Q33: Do you agree with the assessment time for avtur being set at the duty point? Please provide evidence to support alternative approaches.

CALL FOR EVIDENCE

4. The Department would welcome evidence of any circumstances in which the proposed assessment time for avtur could cause compliance challenges.

Assessment time for low carbon avgas

Avgas is subject to fuel duty. Therefore, we propose to use the duty point as the assessment time for low carbon avgas, in line with the current position under the RTFO, and the proposed approach for avtur. The use of the duty point as the assessment time is appropriate for the reasons set out above.

CONSULTATION QUESTION

Q34: Do you agree that the duty point is the most suitable assessment time for renewable avgas?

²⁸ <https://www.gov.uk/guidance/aviation-turbine-fuel-excise-notice-179a#:~:text=4.2%20Recording%20and%20keeping%20information%20about%20supplies%20of%20Avtur>

Assessment time for low carbon hydrogen

Under the RTFO, the assessment time for renewable hydrogen is the point of sale into transport. The owner of the hydrogen at the point of retail sale is the entity eligible to apply for RTFCs. 'Retail' here means a sale of hydrogen to the user and not for resale in the course of a trade or business. This works well in practice under the RTFO for hydrogen used in road vehicles and non-road mobile machinery, but this approach has not yet been tested for aviation use.

For consistency we propose that under the mandate we continue to use the point of retail sale as the assessment time for low carbon hydrogen. **However, we welcome views on whether there are risks to this approach and evidence as to why alternative approaches might work better.**

CONSULTATION QUESTION

Q35: Do you agree that the point of retail sale is the most suitable assessment time for hydrogen? Please provide evidence to support alternative approaches.

End point of chain of custody

Definition of chain of custody

In the context of the SAF mandate, the chain of custody is the sequence of ownership of aviation fuel as it moves through the supply chain. It is also the method used to keep track of the total volumes of sustainable fuel and conventional aviation fuel input and output in the production and supply cycle.

In our SAF mandate government response we confirmed that suppliers must use a mass balance chain of custody to demonstrate compliance with the mandate. As with the RTFO, other more stringent chain of custody systems, such as bulk commodity systems, will also be permitted because they are consistent with the principles of mass balance. The mass balance chain of custody model was deemed the most appropriate as it will provide the fuel with robust proof of sustainability and compliance with the mandate that can be directly traced back from the final fuel to the start of the chain of custody.

Purpose of a defined mandate chain of custody end point

In line with the RTFO the chain of custody for the SAF mandate should start at the point where the feedstock originates i.e. where the waste material arises.

For the mandate, we require proof that fuel has been used in UK aviation, However, voluntary schemes – which suppliers currently rely on to provide assurance over the chain of custody for eligible fuels – typically only cover the chain of custody for SAF to the assessment time. There is no guarantee that once fuel has reached the assessment time it will be used in UK aviation and for this reason, we propose that we will require evidence of forward supply of fuel past the assessment time.

This is consistent with current practice under the RTFO - suppliers must evidence that their aviation fuel has been supplied for use in UK aviation. In practice, this means that it must

have reached a 'point of no return' where the fuel cannot be used anywhere other than UK aviation. Evidence that can be used to prove fuel has reached the point of no return under the RTFO currently includes:

- bills of lading or equivalent transport documentation showing delivery to an airport;
- where avtur has been transported via pipeline in the UK, proof of payment by airlines accompanied by evidence of transport up to, and including, entry into the pipeline; and
- other arrangements as agreed with the Administrator.

We propose that this evidencing of forward supply of fuel continues under the SAF mandate. Further detailed information on the evidence required to demonstrate forward supply will be shared in the mandate guidance.

CONSULTATION QUESTION

Q36: Do you agree with the end point of the chain of custody being the 'point of no return' of the relevant fuel?

Threshold amount below which fuel is not obligated

In the first mandate consultation government response we stated that we were minded to introduce a minimum threshold below which conventional avtur would not be obligated, and would consult further on what level it should be set at.

A threshold would safeguard small amounts of fuel supplied for end uses such as research and testing, for which the amount of SAF obligated to be supplied would be negligible. We consider that it would be disproportionate to apply an obligation to fuel in these circumstances. We propose that suppliers of small volumes who would not be obligated under the mandate are not required to register an account. This will help to avoid unnecessary administrative burden for both the non-obligated parties and for the Administrator.

Under the RTFO, a threshold of 450,000 litres of fuel has been effective and has not led to any negative unintended consequences. When considered from an aviation perspective, a minimum threshold of this level is unlikely to impact on the obligation of established avtur suppliers, as they deal in much larger amounts of fuel than the threshold stipulates.

Based on the above information, we are proposing that suppliers who supply less than 370 tonnes (equivalent to approximately 450,000 litres) of avtur within a reporting period will not have an obligation and will be exempt from the reporting requirements of the SAF mandate.

CONSULTATION QUESTION

Q37: Do you agree with the use of a 370 tonne (approximately 450,000 litre volume) threshold under which conventional avtur is not obligated within the mandate? If not, please provide an alternative and any evidence to support this.

5. Calculating the obligations and certificate reward

As confirmed in the government response to the previous consultation, suppliers of fossil jet fuel²⁹ to the UK aviation market will be subject to two obligations – a standard obligation and a PtL obligation - requiring a minimum amount of SAF to be blended into the fuel supply. To fulfil these obligations, suppliers will be required to redeem a given number of relevant certificates, which can be acquired by submitting claims evidencing the supply of eligible SAF to the UK or purchasing certificates from other suppliers. If an obligation is not fully met, suppliers will be required to pay a sum of money proportionate to the certificate shortfall (buy-out). This chapter sets out in further detail how the obligations are calculated, as well as the practicalities concerning discharging the obligations.

Obligation period

The obligation period is the timeframe over which obligated suppliers will be required to supply their mandated amount of SAF, in line with the targets set out in [Chapter 2](#).

We propose that each obligation period is one year in length, in line with the RTFO. This time period gives suppliers sufficient flexibility to meet their obligations. It allows the supplier to oversupply or undersupply SAF throughout that period as long as they meet their individual obligations on average over the course of the year. Should they have a shortfall in SAF supply it also allows time to source certificates to cover that shortfall. Alternatively, they will need to pay to buy-out of their SAF mandate.

The RTFO runs on a calendar year basis i.e. the obligation period runs from 1 January to 31 December each year. For consistency – given that many of the obligated suppliers will be the same across both schemes - **it is proposed that the SAF mandate will also run on a calendar year basis.** Aligning with the RTFO will simplify compliance for suppliers obligated under both the RTFO and SAF mandate. We intend for the first obligation period to start on 1 January 2025 and end on 31 December 2025. This will also ensure that no period exists where aviation fuel is supported under more than one scheme or not supported at all.

Following the end of each obligation period, we propose that deadlines that suppliers and the Administrator must adhere align to those in the RTFO. That is:

- suppliers will be able to submit claims for SAF certificates for that obligation period until 12 May (see [Chapter 6](#) for more information on submitting claims);

²⁹ Supply of SAF that does not meet the technical and/or sustainability criteria will also be subject to an obligation.

- the revocation deadline is 17 June and the revocation appeal deadline is 15 August (see [section on revocation of certificates](#) for further information);
- the obligations will be calculated on 15 August, at which point suppliers will be able to redeem their certificates against their obligations up until 15 September (see [section on discharging the obligation](#) for more information); and
- the Administrator will calculate the buy-out sums on 21 September and suppliers are due to pay the buy-out sums by 26 October.

CONSULTATION QUESTION

Q38: Do you agree or disagree that the obligation period should run for a one-year period and on a calendar year basis?

Q39: Do you agree or disagree with dates for which actions must be completed following the end of the obligation period?

Suppliers' obligations will be determined according to the amount of energy supplied through aviation fuel

In the first consultation, we confirmed that any fossil avtur or SAF that does not meet the technical and sustainability standards of the UK aviation market will incur an obligation³⁰. We proposed setting the obligations on suppliers to reduce their GHG emissions, by a certain amount, through blending SAF into their fuel mix. The government remains committed to introducing a mandate that prioritises GHG savings and as such will provide greater support for SAF with greater GHG savings through additional certificates.

The legal powers that will be used to implement the mandate only permit “an amount” of fuel to be obligated rather than GHG emissions. Therefore, **we are now proposing to determine each supplier's obligation to supply SAF on the basis of the energy they have supplied through fossil aviation fuel.** An obligation on energy will require obligated suppliers to ensure that a given proportion of the total energy provided by the aviation fuel it supplies comes from SAF. Setting targets in this manner is similar to the percentage volume targets used in the RTFO and will be familiar to industry.

Obligating on the basis of energy will allow us to include emerging technologies in the future. Fuels such as hydrogen can contain a greater amount of energy compared to the same mass of kerosene. Using an energy scheme will fairly reward these fuels on the total energy provided and emissions reductions achieved.

An obligation on energy supplied will reduce GHG emissions to the same level, at the same rate, as a GHG savings obligation. Targets will be set based on the total amount of SAF (on an energy basis) that needs to be supplied annually into the UK's aviation fuel mix. In setting these we have translated what this means for GHG savings that will be achieved, assuming that SAF achieves 70% GHG savings relative to fossil kerosene on average.

CONSULTATION QUESTION

³⁰ For the remainder of this document, we will discuss the obligation as being placed on fossil kerosene or avtur, but it should be taken as implicit that this term also includes SAF that does not meet the technical or sustainability criteria. Fossil hydrogen and avgas will not be subject to an obligation – this is discussed further in [Chapter 3](#).

Q40: Do you agree or disagree that the calculation of each supplier's obligation to supply SAF should be determined on the basis of energy?

Tradeable certificates will be used to demonstrate compliance

The obligation will apply to each supplier on an individual basis, meaning that every obligated supplier will have to supply the appropriate amount of SAF in line with the SAF targets. We propose that suppliers will discharge the obligation by redeeming certificates at the end of the obligation period. Key features of the certificate scheme are that:

- any SAF that meets the technical and sustainability criteria will be rewarded with certificates;
- SAF certificates will be awarded in proportion to the GHG savings achieved (explained in more detail below);
- Certificates are earned by supplying eligible SAF to the UK market or, purchasing a certificate from other SAF suppliers/producers; and
- Compliance with the SAF mandate is achieved by redeeming certificates at the end of the obligation period (one certificate will be required to offset each unit of obligation incurred) or exercising the buy-out (or a combination of both of these); and
- Suppliers that have insufficient certificates to wholly discharge the obligation will be required to buy-out the remainder of the obligation (see [section on discharging the obligation](#)).

This means if a jet fuel supplier does not supply any SAF, the supplier will generate an obligation and must discharge its obligation through purchasing certificates from others or paying to buy out of their obligation.

If a jet fuel supplier only supplies SAF, the supplier will earn certificates and will not have an obligation. The supplier in question can therefore sell the certificates to those that need them.

If a jet fuel supplier supplies both, it will generate a mix of obligations and certificates.

We intend to provide an IT platform where certificates can be traded, similar to the RTFO Operating System (ROS), which is explained further in [Chapter 6](#).

Calculation of obligation

Every supplier that delivers fossil avtur to the UK will incur two separate obligations to supply SAF - a standard obligation (which covers all eligible SAF except PtL) and a PtL obligation. It is proposed that the obligation is calculated by applying the target (as a percentage) (set out in [Chapter 2](#)) to the amount of fossil kerosene (in terms of energy). At the end of the obligation period, the obligation on fossil jet fuel supplied to UK aviation will be calculated as:

$$OBL = m_f \times LHV_f \times E_{target}$$

Standard obligation

$$OBL_{PtL} = m_f \times LHV_f \times E_{target}^{PtL}$$

PtL obligation

Where:

- OBL is the standard obligation incurred by the fossil jet fuel supplier as a result of delivering a fossil kerosene consignment to the UK, in MJ;
- m_f is the mass of fossil kerosene supplied, in kg;
- LHV_f is the lower heating value of the fossil kerosene consignment (i.e. the energy content), in MJ/kg (typically 42.8 MJ/kg for Jet-A1);
- E_{target} is the standard mandate target, as a percentage of energy from produced by fossil kerosene supplied to the UK market;
- E_{target}^{PtL} is the PtL target, as a percentage of energy produced by fossil kerosene supplied to the UK market; and
- OBL_{PtL} is the PtL obligation incurred by the fossil jet fuel supplier as a result of delivering a fossil kerosene consignment to the UK, in MJ;

This means that the incurred obligation will increase as the supply of fossil kerosene increases and also as the mandates to supply SAF increase. As the SAF mandate targets increase over time, in line with the trajectory introduced by the mandate, the same mass of fossil kerosene will incur an increasingly higher obligation year on year.

SAF target as proportion of fossil kerosene

As set out above, we propose that only fossil kerosene or SAF that does not meet the sustainability standards will incur an obligation, while compliant SAF will generate certificates.

Note that, the targets set out in each of the scenarios in [Chapter 2](#) are expressed as percentages of total fuel supplied (i.e. 10% of *all jet fuel* supplied must be SAF in 2030). However, the SAF mandate target applied to calculate a supplier's obligation must be expressed as a percentage of fossil fuel supplied in order to achieve the targets set out in the scenarios (i.e. the proportions in the LHS of Table x). The figures in the RHS of the table are those that will be written into legislation.

As an illustration of how these targets differ, the table below presents indicative, incremental energy targets as a proportion of total fuel supplied and the corresponding targets expressed as a proportion of fossil kerosene supplied.

SAF target as proportion of total fuel supplied, by energy	SAF target as proportion of fossil fuel supplied ³¹ , by energy
10%	11.111%
20%	25.000%
30%	42.857%
40%	66.667%

³¹ Also includes SAF that does not meet the sustainability criteria

50%	100.000%
60%	150.000%
70%	233.333%
80%	400.000%
90%	900.000%

Figure 17: An indicative set of incremental mandate targets expressed as a proportion of total fuel supplied (left column) and the same targets expressed as a proportion of fossil fuel supplied (right column). In this example, it is the targets in the right hand column that would be used to determine the obligation incurred by supply of fossil fuel, and would be written into legislation.

Example 1: fossil kerosene supplied in 2030

The obligation incurred is calculated as follows:

SAF target as proportion of total fuel supplied = 10%

SAF standard target as proportion of total fuel supplied = 9%

PtL target as proportion of total fuel supplied = 1%

SAF standard target as proportion of fossil kerosene supplied = 10.000%

PtL target as proportion of fossil kerosene supplied = 1.111%

Mass of fossil kerosene supplied = 40,000 kg

Lower heating value for kerosene = 43 MJ/kg

Standard obligation = $40,000 \times 43 \times 10\% = 172,000$ MJ

PtL obligation = $40,000 \times 43 \times 1.111\% = 19,109$ MJ

Calculation of certificates

To discharge the obligation in full, the supplier will require an equal number of certificates as the obligation. To acquire certificates, a supplier can:

- supply SAF into the UK aviation market;
- purchase certificates from other SAF suppliers through a trading system (see [section on transfer of certificates](#)); or
- pay a buy-out (see [section on discharging the obligation](#)).

With respect to supplying SAF, each consignment will generate certificates providing the SAF meets the technical and sustainability standards prescribed by the mandate. These certificates must be calculated proportionately to the energy of a given consignment.

However, to ensure this is a scheme that incentivises SAF with the greatest GHG savings, we intend on factoring in the CI of the SAF into the equation. **The preferred approach is for certificates to be rewarded for each megajoule (MJ) of SAF supplied, multiplied by a CI scaling factor.** This is calculated as follows:

$$\text{Certificates} = m \times LHV_i \times CI_{factor}$$

Where:

- *Certificates* is the number of certificates rewarded to a given SAF consignment, in MJ;
- *m* is the mass of a given eligible fuel consignment, in kg;
- *LHV_i* is lower heating value of the eligible fuel (i.e. energy density), in MJ/kg; and
- *CI_{factor}* is the carbon intensity factor, as defined below.

The purpose of the CI factor is to reward SAF in line with GHG savings achieved. This approach to calculating the certificates will ensure that CI reductions are rewarded and that the energy density of different fuels is taken into account. For example, hydrogen has a significantly higher energy content per kilogram than kerosene and should be rewarded accordingly. Should any fuels be added to the mandate in the future, the appropriate lower heating value can be inserted into the equation without the need to develop an energy multiplier. This should help avoid inaccuracies.

The lower heating value for a given fuel may vary slightly due to external conditions, however, this can be challenging for suppliers to calculate and would require additional administrative resources. Instead, we propose that a standard value provided by Annex III of the EU RED³² is to be used in all calculations.

Calculating the carbon intensity factor of SAF

The CI factor will deliver on the key objective of the mandate to reward SAF proportionate to the GHG savings achieved. As a starting principle, it is assumed that SAF with a CI of 26.7 gCO₂e/MJ is the average CI of SAF and is therefore allocated a CI factor of 1; as a result, SAF that is supplied with this CI will receive one certificate per MJ. SAF with a lower CI than the baseline SAF will be rewarded more certificates per unit of energy supplied, while a fuel with higher CI will be rewarded less certificates per unit of energy supplied. We welcome views on whether 26.7 gCO₂e/MJ (equal to 70% reduction compared to fossil kerosene) should be assumed as the average CI of SAF, while recognising that there will be a significant range of values that SAF achieves.

We propose that the CI factor for a given SAF consignment will be calculated as the difference in CI between fossil kerosene and the supplied SAF, relative to the CI difference between fossil kerosene and a baseline SAF. This is expressed in the following equation:

³² https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2018.328.01.0082.01.ENG&toc=OJ:L:2018:328:TOC

$$CI_{factor} = \frac{CI_f - CI_{SAF}}{CI_f - CI_b}$$

Where:

- CI_{factor} is the carbon intensity factor;
- CI_f is the lifecycle carbon intensity of fossil kerosene, in gCO₂e/MJ (this is fixed at 89 gCO₂e/MJ for Jet-A1);
- CI_{SAF} is the lifecycle carbon intensity of the supplied SAF consignment, calculated in line with the GHG emissions methodology prescribed by the mandate, in gCO₂e/MJ; and
- CI_b is the lifecycle carbon intensity of a baseline SAF which is assumed to achieve the average GHG savings, in gCO₂e/MJ (we propose this is set at 26.7 gCO₂/MJ, which is equal to 70% GHG savings relative to fossil kerosene).

We propose that fuel suppliers will be rewarded on a continuous basis with increasing certificates for every 0.1 gCO₂e/MJ savings achieved. This will introduce an incentive for suppliers to continually improve the CI of the fuel mix. As proposed here, the number of certificates increases linearly with carbon intensity reduction. We welcome views on whether a linear relationship will provide a proportionate reward for fuels with greater GHG savings or whether an exponential relationship should be considered.

An alternative approach could introduce a banded CI factor, which would allocate CI factors to predefined ranges (see table below). This could reduce the likelihood of fraud, as it is assumed most supplied SAF will not fall close to the edge of the banding. However, it will not provide the same continuous incentive and could result in fuels with significantly different CI receiving the same reward. We welcome views on the risk of fraud in a continuous system compared to a banded system, as well as any other practical considerations that should be taken into account.

Carbon intensity range (gCO ₂ e/MJ) ³³	Carbon intensity factor
44.5 – 35.5	0.79
34.4 – 26.7	0.93
26.6 – 17.8	1.07
17.7 – 8.9	1.21
8.8 – 0	1.36

Figure 18: Table showing potential option of a banded CI factor

CONSULTATION QUESTIONS

³³ The proposed calculation of the CI factor would also allow negative emissions to be rewarded, should the Department commit to rewarding certificates for negative emissions.

Q41: Do you agree or disagree with the calculation of certificates set out above?

Q42: Do you consider there to be any potential issues with fraud adopting a continuous approach compared to a banded approach?

Q43: Do you agree or disagree with the calculation of the carbon intensity factor?

How does the carbon intensity factor impact the amount of SAF supplied to meet the obligation?

The CI factor will influence the amount of SAF needed to generate sufficient certificates to offset a given obligation. As an example, SAF with a CI of 41.3 gCO₂e/MJ will receive 0.77 certificates per MJ of SAF supplied, while SAF with 13.8 gCO₂e/MJ will receive 1.21 certificates per MJ, using the proposed equation. Assuming the energy density of these types of SAF is fixed, obligated parties will have to either blend less or more fuel (and therefore energy) to meet the same obligated amount. We welcome views on whether 26.7 gCO₂e/MJ (equal to 70% reduction compared to fossil kerosene) should be assumed as the average CI of SAF, while recognising that there will be a significant range of values that this has been illustrated in **Example 2**.

Given that the CI factor influences the amount of fuel required to meet the obligation, the factor will ensure that a fixed emissions saving is achieved for SAF with different CI. The figure below shows that the emissions savings remain the same for indicative SAF consignments with different CI, each of which have generated sufficient certificates to meet the obligation. This method to calculating the CI factor ensures that, for a given type of fuel, the emissions savings achieved by supplying SAF, compared to an equivalent mass of fossil kerosene, are the same no matter what the CI of the SAF is.

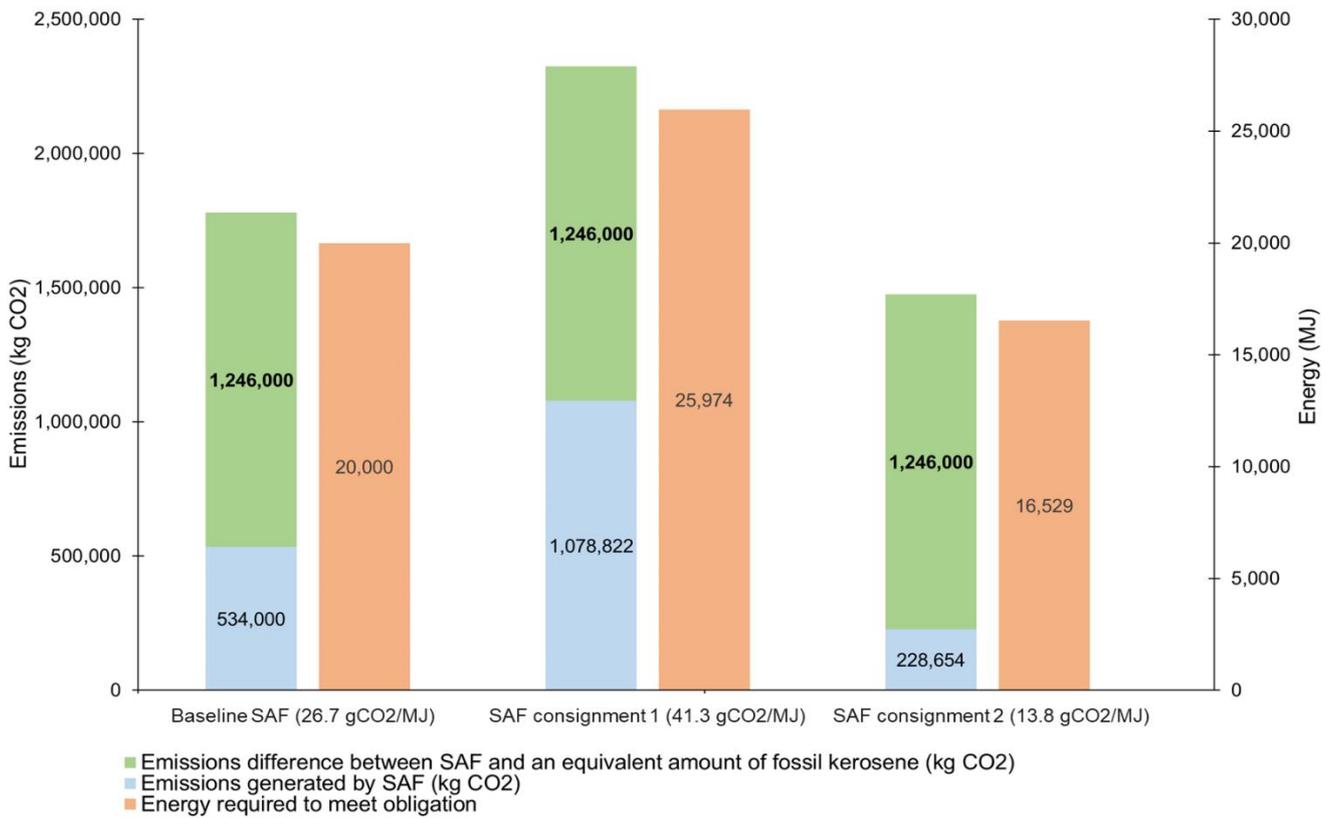


Figure 19: Three indicative SAF consignments with different CI each supplied at an amount that would generate a sufficient number of certificates to offset an obligation of 20,000. The orange column indicates the amount of SAF needed supplied for to offset the obligation, where the specific amount is determined by the CI factor and energy density. The left column represents the CO2 emissions, where the blue column is the amount of emissions produced by the SAF and the green column is the amount of emissions saved compared to the emissions produced by an equivalent amount of fossil kerosene.

Example 2: calculation of certificates

Two different SAF consignments are supplied to the UK aviation market by different suppliers – Supplier 1 supplies SAF with a CI of 41.3 gCO2e/MJ and Supplier 2 with SAF of 13.8 gCO2e/MJ. They both supply 500kg of their SAF.

The CI of fossil kerosene is considered to be 89.0 gCO2e/MJ with a lower heating value of 42.8 MJ/kg.

Supplier 1

The CI factor for the first SAF consignment is calculated as:

$$(89.0 - 41.3)/(89.0 - 26.7) = 0.77$$

The number of certificates rewarded to the SAF consignment is:

$$500 \times 42.8 \times 0.77 = 16,478$$

Supplier 2

The CI factor for the second SAF consignment is calculated as:

$$(89.0 - 13.9)/(89.0 - 26.7) = 1.21$$

The number of certificates rewarded to the SAF consignment is:

$$\text{Certificates} = 500 \times 42.8 \times 1.21 = 25,894$$

Notes

For both of the suppliers, the amount of energy is calculated as followed:

$$\text{Energy} = \text{mass} \times \text{lower heating value} = 500 \times 42.8 = 21,400 \text{ MJ}$$

As demonstrated, although both suppliers supply the same amount of SAF in terms of mass and energy, they are rewarded with a different number of certificates. As a result, the CI will influence the amount of SAF that is needed to offset the obligation.

If, for example, the obligation incurred by the supply of fossil jet fuel was 20,000. Supplier 1 would be required to supply 607 kg to offset the obligation, while Supplier 2 would have to supply 386kg. The above figure shows that if these amounts are supplied, the emissions savings relative to fossil jet fuel are constant between the consignments.

CONSULTATION QUESTION

Q44: Is 26.7 gCO₂e/MJ an appropriate assumption for the average carbon intensity of SAF? Please provide any available evidence if suggesting an alternative value.

Recognising negative emissions

Across most of the main SAF production pathways, CCS can be incorporated to capture carbon streams released during the production process and reduce the carbon intensity of the resulting SAF. In some cases where biogenic feedstock is used, the addition of CCS in SAF production could result in net negative emissions depending on the carbon balance across the project lifecycle. We are keen to encourage the integration of CCS in SAF production through the design of the policy mandate while ensuring we complement existing and future policy targeting CCS specifically.

Independent external analysis carried out by E4Tech on behalf of DfT shows that while most SAF production pathways can utilise CCS, gasification plus Fischer-Tropsch technologies producing biofuels have the greatest potential for net negative emissions given the high concentration of biogenic carbon produced. Analysis suggests that the addition of CCS to SAF production pathways could increase the GHG emissions reduction to 81%-232% compared to fossil kerosene – this compares to typical GHG emissions reduction of around 50-82% for SAF without CCS. The GHG savings achieved depends on the production pathway and feedstock employed, with gasification plus Fischer-Tropsch the only pathway with potential to achieve net negative emissions on a lifecycle basis. We welcome any further evidence on the potential impact of installing CCS in SAF production plants on GHG reductions.

The government is keen to recognise all GHG emission reductions, while maintaining that any reward must be proportionate. Evidence suggests that the GHG emissions reduction

achieved by installing CCS in a SAF plant could cost less per tonne than the carbon savings achieved by SAF production without CCS. As a general principle, we do not intend to distinguish the certificate reward by how the reduction in carbon intensity is achieved. Therefore, given the lower abatement cost, there will be a strong incentive to install CCS in plants and receive certificates for high GHG emissions reduction, in particular where the pathway has potential to achieve negative emissions. However, this could reduce the total volumes of SAF supplied. Furthermore, SAF pathways with greater potential for CCS and in particular negative emissions could be excessively rewarded such that they push other pathways out of the market. This would go against our objective to create a diverse SAF portfolio in the UK, thereby increasing risk around relying on one specific feedstock or production pathway and potentially reducing the overall amount of SAF brought to market.

More broadly, we recognise the importance of consistency between the SAF mandate and wider government policy on negative emissions to ensure a level playing field across greenhouse gas removal (GGR) technologies. Last year, the Department for Energy Security and Net Zero (DESNZ) consulted on the design of a GGR business model and invited views on its potential applicability to BECCS projects in the biofuels sector. Additionally, the 'Developing the UK ETS' consultation, published in March 2022, contained a call for evidence exploring the role of the UK ETS as a potential long-term market for GGRs. The government responses to the consultations will be published later this year.

When developing our proposals on the treatment of negative emissions under the SAF mandate, we will ensure that this is appropriately aligned with wider government policy on negative emissions markets and incentives in order to avoid perverse impacts; for example, by creating market distortions or a competitive advantage for SAF projects over other negative emissions production technologies. In addition to this, there are complex practical issues that need to be considered. For example, how imported fuel that incorporates CCS abroad is accounted for and rewarded under the mandate.

We are therefore not in a position to set out a preferred option on the treatment of negative emissions at this stage, and will conduct further work to explore whether negative emissions from SAF projects should be rewarded under the SAF mandate or other negative emissions incentive frameworks. We recognise that the decision on how negative emissions are treated under the mandate will influence the business case of SAF production plants. The government will continue to determine how best to support integration of CCS in SAF production as quickly as possible.

CALL FOR EVIDENCE

6. Please provide evidence of the impact of CCS on lifecycle GHG savings that can be achieved by SAF, including the potential for negative emissions.

CONSULTATION QUESTIONS

Q45: In your view, should GHG reductions from CCS be rewarded under the SAF mandate? If so, should the reward extend to net negative emissions (i.e. less than 0 gCO_{2e}/MJ on a lifecycle basis), or should these be supported by an alternative GGR policy or a combination of policies?

Types of certificates

Given that the mandate will prescribe a maximum amount of HEFA that is claimed under the standard obligation and a separate PtL obligation, it will be necessary to award separate certificates to distinguish HEFA and PtL consignments from other types of SAF. It is proposed that:

- HEFA will generate HEFA certificates (HC)
- PtL will generate PtL mandate certificates (PMC)
- All other types of SAF, including low carbon hydrogen and low carbon drop-in replacement for avgas, will generate standard mandate certificates (SMC)

The calculation to determine number of certificates will be same for each type of mandate certificate but suppliers must provide the type of SAF when submitting claims so that the certificates can be labelled appropriately.

Discharge of obligation

Throughout the year, an estimate of the obligation will be provided. However, an accurate final obligation will not be issued to the supplier until all fossil and SAF consignments have been validated. **We propose that the final obligation is calculated on 15 August following the obligation period.** At this point, suppliers will be required to redeem certificates against the obligation through the IT system.

Once the Administrator notifies the supplier of the obligation, we propose that they will take the same actions as under the RTFO to advise suppliers on their certificate balance. That is, each supplier must redeem certificates against the relevant obligation by 15 September. Where a supplier fails to do this, the Administrator will deem the number of certificates to be redeemed as nil.

Each supplier will be issued with two obligations: a standard obligation and a PtL obligation. These will be calculated as a sum of obligations incurred through the supply of fossil kerosene, throughout the obligation period. The obligation is wholly discharged once a supplier redeems an equal number of relevant certificates against the obligation.

The government is keen to encourage the supply of SAF beyond the target set in the mandate. In particular, PtL is seen as an important fuel and the scaling up should be accelerated as quickly as possible. The scenario may arise where a supplier has an excess of PtL certificates but does not have sufficient certificates to fulfil the main obligation. Therefore, it is proposed that:

- a PtL obligation can only be redeemed using PMC; and
- a standard obligation can be redeemed using SMC, PMC and/or HC.

This could encourage suppliers to supply beyond the PtL obligation and support the suppliers that have greater access to PtL over other fuels. Given that the buy-out price of the PtL certificate is set at a higher price (as outlined in [Chapter 2](#)), we propose that the reverse use is not allowed i.e. excess standard certificates will not be eligible to fulfil the PtL obligation.

As set out in [Chapter 2](#), we propose to introduce a cap on the amount of HEFA that can count towards the standard obligation. This means that the number of HC that can be redeemed against the standard obligation by an individual obligated supplier cannot exceed the HEFA cap, which is calculated using:

$$HEFA_{cap} = m_f \times E_{cap}^{HEFA} \times LHV_f$$

Where:

- $HEFA_{cap}$ is the maximum amount of HMC that can be redeemed against the standard obligation;
- m_f is the total mass of fossil kerosene supplied in that obligation period, in kg;
- E_{cap}^{HEFA} is the HEFA cap, as a percentage of the SAF supplied (see [Chapter 2](#));
- LHV_f is the lower heating value of the fossil kerosene consignment (i.e. the energy content), in MJ/kg (typically 42.8 MJ/kg for Jet-A1).

Following this method, the amount of HEFA that a supplier can claim under the mandate is proportionate to the energy of SAF supplied. This means that, in absolute terms, the greater the energy of SAF supplied, the greater the number of HEFA certificates that can be redeemed by that supplier.

Any supplier that does not wholly discharge the obligation will be required to pay the buy-out for the remainder of the obligation. We propose that the amount owed by the supplier will be calculated by multiplying the standard and PtL buy-out price (set out in [Chapter 2](#)) by the respective certificate shortfall, which will be sent to suppliers on 27 September and should be paid by 26 October. Should the supplier not wholly discharge the obligation with the buy-out by this date, we propose that the unpaid buy-out amount will be subject to an annual interest of 5% above the base rate set by the Bank of England, but to be calculated on a daily basis starting from 27 October. This approach, including the dates by which actions must be taken, aligns with the RTFO which we do not see any reason to diverge from.

CONSULTATION QUESTIONS

Q45: Do you agree or disagree with the steps taken by the Administrator and the supplier to discharge the obligation at the end of a period?

Q46: Do you agree or disagree with the approach to calculating the HEFA cap?

Q47: Do you agree or disagree with the approach to paying the buy-out amount when a supplier does not wholly discharge its obligation?

6. Submitting claims, reporting the required data, and fulfilling the SAF obligation

It is critical that the fossil fuel information submitted by suppliers, as well as the carbon and sustainability information of SAF, is credible and accurate such that the obligation and reward of certificates can be calculated correctly. It is therefore necessary that the mandate includes robust processes that suppliers must undergo when providing any relevant data to DfT.

In the government response we confirmed the high-level elements that will guide the practicalities, reporting and verification of the scheme. This included the allowing voluntary schemes to count as evidence of compliance with the sustainability criteria and introducing a requirement to have sustainability information verified.

This chapter goes further to outline the detailed processes that suppliers will have to undergo to submit fuel information and claim certificates, as well as the role of the Administrator in issuing certificates. As a general principle, we have put forward proposals that mirror the RTFO as these have been successfully implemented for many years and are well understood by suppliers complying with the scheme.

Provision of an IT system to facilitate administration of the scheme

We propose that an IT system will be developed, which will function as the principal tool for both the Administrator implementing the requirements of, and suppliers complying with, the mandate. The online database would be used for recording the amount and carbon intensity of fuel supplied, information on the sustainability of those fuels, calculating a company's obligation and issuing certificates. The proposed system would also enable suppliers and traders to transfer certificates to each other and to redeem them to meet the obligation. We intend to model the IT system on the RTFO Operating System (ROS) – either as an extension or separate system - ensuring that it is updated to accommodate the requirements of the SAF mandate.

Requirement for each obligated party to have an account

Each obligated supplier will be required to apply for an account with the Administrator. We propose that the Administrator will first determine there is sufficient evidence or information to accept the application and then proceed to establish the account. As currently happens under the RTFO, we propose that the Administrator reserves the right to record and retain information submitted as part of this process for at least ten years.

We intend on introducing a requirement that each supplier must create its account within 28 days, starting from the date on which the supplier becomes obligated. We propose that any other aviation fuel supplier that intends to trade or invest in certificates - but is not subject to the obligation - will be eligible to apply for an account at any time, providing they have good reason to hold an account.

We propose that the Administrator has the power to close accounts in certain situations. This includes when a supplier no longer has a good reason to hold an account; where all certificates standing to the credit of the account have been revoked; or where no certificate has been issued or credited to the account of an account holder within the previous 36 months.

CONSULTATION QUESTION

Q48: Do you agree or disagree with the approach to creating and closing accounts?

Submitting claims for SAF certificates

Before a supplier can apply for certificates under the mandate, it is proposed that the supplier must:

- submit carbon and sustainability information that demonstrates that the fuel has met the sustainability criteria, including a verifier's assurance report attesting to this;
- submit evidence of the amount of fuel supplied to the UK aviation market, such that it can be validated;
- meet the other stipulations discussed in this consultation such as having an account, owning the fuel at the assessment point and having supplied the fuel into the UK for aviation fuel purposes; and
- declare that the fuel has not been used towards the targets in other schemes (see [Chapter 7](#) for further information on multiple incentives).

These are the same stipulations that the RTFO enforces, which we deem to be an effective approach. When a supplier submits a claim, the Administrator will be required to evaluate the application against the requirements stipulated, referring to the verifier's opinion as necessary (see section below). In the event of an application being rejected, the Administrator will inform the supplier as to why the application has been rejected.

We plan to give suppliers the responsibility to ensure that information provided in the application is accurate and has been provided in line with prescribed methodologies.

It is envisaged that suppliers may choose how often to apply for certificates within the given reporting period and that the Administrator will issue certificates as quickly as reasonably possible after claims have been approved. In line with the RTFO, **we propose all applications for certificates must be submitted by 12 May** following the obligation period in order to be eligible to be redeemed against that obligation.

CONSULTATION QUESTION

Q49: Do you agree or disagree with the approach to submitting claims?

Carbon and sustainability information

Reporting carbon and sustainability information

All suppliers wishing to apply for certificates for the SAF they have supplied will be required to report sustainability information demonstrating compliance with the sustainability criteria. Furthermore, we propose that suppliers must arrange for their data to be independently verified before submitting an application.

We plan for carbon and sustainability reports to be submitted per administrative consignment (i.e. any amount of product with an identical set of sustainability characteristics) to ensure that sustainability criteria is met. It is envisaged that the process for completing a carbon and sustainability report will be consistent with that currently in the RTFO. That is that the proposed IT system provides carbon and sustainability fields that are required to be filled in with relevant data by the supplier when submitting a claim. A comprehensive summary of the information to be provided for each consignment of fuel, as well as which of these data fields are required and which are elective, will be set out in guidance. However, we do not envisage that any further data types beyond those required by the RTFO will be needed in the mandate.

Demonstrating compliance with sustainability criteria

Carbon and sustainability reports must contain the information required to demonstrate compliance with the sustainability criteria. In the government response published in July, it was confirmed that voluntary schemes would be eligible to count as a route to demonstrate compliance but would not be mandatory. Voluntary schemes are sustainability assurance schemes recognised by the Administrator as demonstrating compliance with one or more of the sustainability criteria. Experience from the RTFO shows that verification effort is likely to be reduced where the fuel meets a voluntary scheme's requirements, particularly where those schemes cover the full chain of custody and all of the sustainability data. Therefore, it will be the recommended option under the SAF mandate.

We anticipate that voluntary schemes could be recognised for a specific scope. For example, certain feedstocks, geographies, one or more of the land-use criteria, the GHG criteria and the mass balance system. Any carbon and sustainability information included in a report which is not covered by the scope of the voluntary scheme will be subject to verification. Our expectation is that DfT will provide a list of approved voluntary schemes with their respective scope, which will be published ahead of the mandate starting in 2025. Details on the assessment process for voluntary schemes carried out by the Department will be published in the guidance.

Where a supplier does not use a voluntary scheme, or where there is no appropriate voluntary scheme available for use, suppliers will be required to demonstrate compliance against given sustainability criteria using other approaches. Such approaches will be set out in detail in the guidance published by the Administrator.

Chain of custody

As confirmed in the government response published in July, suppliers must use a mass balance chain of custody to demonstrate compliance with the mandate. As is the case with the RTFO, other more stringent chain of custody systems such as bulk commodity systems will also be permitted as they are consistent with the principles of mass balance. This chain of custody allows amounts of relevant feedstock or fuel with different sustainability characteristics to be mixed, which we believe is the most practical solution when dealing with jet fuel supply. Furthermore, it allows the sustainability characteristics of a feedstock, such as type and place of origin, to be tracked throughout the system.

Suppliers will need to check whether a voluntary scheme includes an approved chain of custody and whether it covers the entire supply chain, or only a part of it. Where part or all of a supply chain is not covered by a voluntary scheme, we propose that suppliers must set up their own chain of custody, ensuring that a mass balance approach is used to balance the inputs and outputs from each entity in the chain. Guidance on how to set up a chain of custody and on the detailed rules of operating a mass balance system will be published by the Administrator.

Verification of carbon and sustainability information

As confirmed in the government response, carbon and sustainability data will need to be verified before an application can be submitted. This verification of data will be carried out in accordance with the ISAE 3000 standard (or an equivalent standard), by a person who is independent of the supplier and who has the necessary expertise. The verifier's report will consider the accuracy and robustness of data, stating whether the data has been prepared in line with what is expected by the Administrator.

To maintain consistency with the RTFO, **we propose that verification should be carried out to the limited level of assurance**. A reasonable assurance could require a higher level of evidence gathering through increased sampling but would likely come at an additional cost to suppliers.

It is anticipated that suppliers will be able to forward their data to a verifier on the IT system such that the verifier can examine the data directly. Once verification is complete, the verifier will return the data to the supplier and upload their assurance opinion. The supplier will be responsible for submitting the application, including the assurance opinion, to the Administrator. Further guidance for suppliers on appointing a verifier will be published, in addition to specific guidance for verifiers on the processes that they will undertake.

CONSULTATION QUESTION

Q50: Do you agree or disagree with the approach to reporting, demonstrating compliance with and verifying the carbon and sustainability information?

Validating fuel amount information

We previously confirmed that obligated suppliers will need to report information on the aviation fuel supplied to DfT, regardless of whether they claim SAF certificates under the mandate. These fuel amounts will be submitted by the supplier when completing the carbon

and sustainability information. We propose that the suppliers must provide information on the mass of fuel, by fuel type, that is owned at the assessment time.

It will be necessary to have the amount of fuel validated. The simplest approach to validating fuel amounts is by receiving HMRC duty data which is checked against fuel amounts submitted by the supplier. We are currently entering an agreement with HMRC to share aviation fuel information with us such that we will be able to validate the fuel amount.

Where a fuel amount is not checkable against HMRC data, for example where a single duty code covers both fossil and renewable elements, or for fuels without a suitable duty point, we propose the Administrator will have the power to require further evidence. This could include:

- requiring the supplier to provide evidence for each and every submission;
- assessing the systems and processes that the supplier uses to derive these quantities on a periodic basis and with the supplier providing assurance to the Administrator that these systems have been used for each submission; or
- requesting that a supplier obtains independent verification of the quantities.

CONSULTATION QUESTION

Q51: Do you agree or disagree that the Administrator should validate fuel amount information?

Q52: Do you agree to disagree to the powers granted to the Administrator to validate fuel amounts where information is not checkable against HMRC data?

Awarding certificates

Where each of the requirements described have been met and the application is successful, we propose that the Administrator will issue the certificate as soon as is reasonably practical by crediting the supplier's electronic account on the IT system. The Administrator will specify whether the certificate awarded is a HEFA, standard or PtL certificate.

Transfer of certificates

In the government response to the first consultation, we confirmed that obligated suppliers will be able to trade certificates in order to meet the obligation in a flexible manner. For suppliers that generate an excess of certificates through supplying SAF to the UK market, a tradeable scheme will offer an additional revenue stream. Meanwhile, those suppliers that have not generated enough certificates to offset the obligation have the opportunity to purchase certificates at a potentially lower value than the buy-out price.

It is proposed that the process of transferring certificates between suppliers will be the same as that in the RTFO currently meaning that the pricing and financial aspects of the trade will be outside the Administrator's scope and systems. However, in order to perform the transfer, the account holder is expected to notify the Administrator of:

- the name and account number of the account holder to whom the certificate is transferred;
- the date of the transfer;

- the obligation period in respect of which the certificate was issued; and
- the number of certificates.

We propose that transfers are managed through the IT system where suppliers/traders will need to specify the above information on the system - either on the date of the transfer or before and for this process to be repeated for each individual transferee should multiple trades take place.

Under the RTFO, once the Administrator is satisfied with the information provided and does not see any grounds for revocation of certificates, the Administrator will transfer the certificates. In the event of there being an insufficient number of certificates for multiple transfer, the Administrator will give priority to the transfer which was first notified. Providing the above requirements are met, suppliers will be eligible to transfer certificates as many times as they wish, as currently happens under the RTFO.

CONSULTATION QUESTION

Q53: Do you agree or disagree with the approach to transfer of certificates?

Introducing flexibility in fulfilling obligation

The amount of SAF that a company supplies to the UK market is unlikely to stay at a consistent rate. It is anticipated that feedstock supply will experience periods of fluctuating output, which will impact SAF production and in turn impact a supplier's ability to generate certificates under the SAF mandate. This will also influence the type of SAF that is brought to the market. We anticipate this to be particularly pertinent in the early years as new production facilities are developed and supply chains are built up.

To mitigate issues arising from fluctuating SAF production, **we propose that excess certificates can be used to fulfil up to a given proportion of the obligation in the following obligation period. We also propose that excess PtL certificates can be used to fulfil the main obligation.** We propose that:

- Standard certificates can be used to fulfil up to 25% of the standard obligation in the following obligation period;
- PtL certificates can be used to fulfil up to 25% of the PtL obligation in the following obligation period; and
- HEFA certificates can be used to fulfil the standard obligation in the following obligation period up to 25% of the HEFA cap.

A key benefit of this approach is that suppliers are not required to obtain the exact number of certificates within a given obligation period to offset their obligation. This will lead to cost effective compliance and greater certainty for suppliers which will always be rewarded with certificates for the supply of SAF (even where supply has exceeded targets). This mechanism could encourage suppliers to go beyond their target, potentially increasing the overall amount of SAF supplied to the UK aviation market. We have found this approach to be effective under the RTFO.

As previously discussed, the mandate and RTFO are standalone instruments where the certificates are not tradeable between the two schemes. This means that any dRTFCs

awarded for the supply of SAF under the RTFO in the 2024 calendar year will not be eligible under the RTFO once the SAF mandate commences in 2025.

CONSULTATION QUESTIONS

Q54: Do you agree or disagree that excess certificates can be used to fulfil the obligation in the following period? If so, do you agree or disagree with the proportion of the obligation that the excess certificates can fulfil?

Q55: Do you agree or disagree that excess PtL certificates can be used to fulfil the main obligation?

7. Interactions with other domestic and international policy

The government previously confirmed that **GHG emissions reductions claimed under other emissions schemes cannot also be claimed under the SAF mandate. In addition, GHG emissions reductions under the mandate cannot be claimed under other emissions schemes.** This does not mean that a batch of fuel rewarded under the mandate cannot be used to meet an obligation in another scheme, but instead that the GHG emissions savings cannot be counted more than once. This is to avoid the overestimation of GHG emissions savings, and therefore incorrect carbon accounting, so that we can accurately monitor the contribution of SAF to net zero.

It was also confirmed that **SAF produced at industrial plants or clusters which have received government funding will be eligible for support under the SAF mandate.**

Our first consultation focused on potential interactions between the mandate and specific domestic and international policies such as the UK ETS and CORSIA. For the purposes of setting the mandate out in legislation and for future-proofing the scheme, it is important that rather than focusing on interactions between individual policies or forms of support, we set out an approach that will cover interactions with current and future schemes.

With regards to specific considerations on interactions between the ETS and the SAF mandate, the 'Developing the UK ETS' consultation included a Call for Evidence on how SAF should be treated under the UK ETS. The government response, to be published in due course, will include a UK ETS Authority response to stakeholder views.

Claiming support for SAF across multiple schemes

We propose that as far as possible the SAF mandate should align with multiple incentive rules set out in the RTFO. The RTFO approach has worked well in practice since 2011 for road fuel and similarly for the small volumes of SAF that have been claimed under the RTFO since its inclusion in 2018.

Work is ongoing to ensure multiple incentive rules are appropriate following the UK's exit from the EU, balancing the need for a level playing field under the SAF mandate and the operations of the UK's trade remedies authority. Engagement with stakeholders on this is ongoing outside of the SAF mandate consultation and is due to continue at pace.

CONSULTATION QUESTION

Q56: Do you agree or disagree with the proposed approach to align mandate multiple incentives rules as much as possible with the RTFO?

Tankering

When designing the mandate, it is important to consider the risk of creating unintended consequences. One potential response to the mandate is airlines opting to take on additional fuel for inbound trips to the UK to cover the outbound trip and avoid having to pay the additional SAF costs from refuelling in the UK. This is known as ‘tankering’ which can result in carbon leakage, even when taking into consideration the carbon emissions saved through SAF use. Although tankering can be practiced for operational purposes, such as avoiding technical failures or contaminated fuel at destination airports, research suggests that 90% of tankering events are due to fuel price reasons³⁴.

Tankering allows airlines to avoid refuelling in airports where the fuel is more expensive. However, the additional weight added to the aeroplane from the unnecessary additional fuel results in more fuel being used overall. This means that it is typically advantageous to tanker on short-haul flights only. There is a risk that as SAF use increases, the length of journey where tankering is considered economical also increases. As a result, the SAF mandate could incentivise tankering behaviour from beyond just the closest EU Member States to North Africa and non-EU European countries. Airlines operating long-haul flights over a certain distance will still generally be unable to tanker as it would exceed the maximum landing weight³⁵.

Although there is no UK-centred research available, independent analysis of the EU SAF mandate indicates that tankering could reduce the emissions savings by 27% in 2035 if no provisions to reduce tankering are introduced³⁶. However, this study does not account for the SAF uptake in the UK where half of tankered flights to the EU originate from. It is expected that the introduction of both the UK and EU mandate from 2025 will reduce the incentive to tanker between these regions. Nevertheless, even small differences in SAF uptake or price will risk tankering between the two regions, particularly between the closest airports. At the same time, carbon pricing measures such as the UK ETS and CORSIA will reduce the risk of tankering, due to the penalty on fossil fuel use and incentives on SAF uptake³⁷.

In response to the first consultation, some stakeholders suggested the introduction of a requirement for airlines to uplift a minimum amount of fuel when departing UK airports to reduce tankering. This mechanism has been proposed by the EU, whereby airlines will be required to uplift at least 90% of the fuel required to carry out an outbound journey when departing an EU airport. The uplift requirement, in combination with carbon pricing measures, is projected to reduce the impact of tankering by up to 42%³⁸. In particular, tankering from bordering countries to the east and south of the EU is expected to reduce as a result.

However, the incentive for tankering from these countries to the UK will not be significant given the longer distances involved. Moreover, we recognise that such a measure would

³⁴ <https://www.eurocontrol.int/sites/default/files/2020-01/eurocontrol-think-paper-1-fuel-tankering.pdf>

³⁵ The maximum landing weight prescribes the maximum mass, including fuel, at which an aircraft is safe to land.

³⁶ <https://theicct.org/wp-content/uploads/2021/06/tankering-eu-SAF-mandate-apr2021.pdf>

³⁷ <https://www.frontier-economics.com/media/5109/economic-research-on-the-impacts-of-carbon-pricing-on-the-uk-aviation-sector.pdf>

³⁸ <https://www.transportenvironment.org/discover/tankering-in-aviation/>

introduce additional administrative burden on airlines, which are already subject ETS and CORSIA reporting activities.

Nevertheless, given the uptake trajectories for both the UK and EU SAF mandates are yet to be finalised, as well as ETS policy in both regions, it is difficult to determine the extent of potential tankering behaviour and how this impacts emissions savings. Once preferred positions are set out, it will be possible to conduct analysis to this end. Therefore, we are not currently in a position to determine whether a minimum uplift requirement would be a proportionate response. However, we welcome views and supporting analysis on whether the extent of tankering as a result of the SAF mandate justifies the introduction of a minimum uplift requirement.

CONSULTATION QUESTION

Q57: Does the risk of tankering as a result of the SAF mandate justify the introduction of a minimum uplift requirement? Please provide supporting evidence if available.

8. Enforcement

Enforcement is an important element of any regulatory scheme. It is the method through which a regulatory body can encourage compliance in a fair and transparent manner. However, it will only be necessary in specific circumstances where issues cannot be resolved. The RTFO Administrator has a long history of working with obligated parties and carrying out compliance checks to ensure that any problems are addressed before further enforcement is required. We envisage the SAF mandate Administrator to have the same working relationship with obligated jet fuel suppliers. Where parties fail to meet obligations, proportionate sanctions can be applied, which will also reassure the compliant majority that they will not be disadvantaged by those that do not meet their obligations. We plan to do this by revoking certificates as a first response, followed by issuing civil penalties if necessary.

Revocation of certificates

To enforce a consistent standard of information that is both accurate and trustworthy when submitting claims, it will be necessary for the Administrator to have the power to revoke certificates if certain criteria are not met. In line with the RTFO, **we propose that possible reasons for revoking a certificate are insufficient, inaccurate, or fraudulent information present in the application for the certificate** including in the carbon and sustainability information, the verifier's assurance report and any declarations involved in the process.

We propose that a similar process to the current RTFO is adopted. That is, where the Administrator sees sufficient grounds to revoke a certificate, we propose that:

- the Administrator will notify the supplier outlining the reason why they intend to pursue a revocation as well as the supplier's right to argue against the revocation within 14 days of receiving the notification;
- the Administrator must consider any representations and make a decision on whether to revoke the certificate but not within 28 days of notifying the supplier;
- should the Administrator decide to revoke the certificate, they will notify the supplier within seven days of the revocation;
- following this notification, suppliers will have 14 days to apply to the Administrator to reconsider the revocation; and
- the Administrator will also be required to reconsider the revocation where the Administrator will either re-instate the certificate or confirm the revocation.

Under the RTFO, there are approximately 10 instances of revocation per year. The majority of these are brought to the Administrator's attention by the supplier and are due to unintended inaccuracies, such as paperwork errors. Currently, the Administrator must wait at least 28 days before completing the revocation, during which time the certificate may have

been traded several times and could be challenging to identify. Therefore, **we propose that where a supplier notifies the Administrator of a mistake and requests a revocation, the Administrator has the power to revoke the certificate immediately.**

CONSULTATION QUESTION

Q58: Do you agree or disagree with the approach to revoking certificates?

Civil penalties

Under the RTFO, the Administrator has the power to issue civil penalties to ensure compliance. We plan to include the same powers in the SAF mandate legislation meaning that, should an obligated supplier or an account holder applying for certificates fail to meet certain criteria, the Department for Transport can impose civil penalties as an act of enforcement. Though, such penalties will only be imposed after the Administrator has given sufficient notification to the party in question and provided opportunity to rectify the issue.

We propose that a supplier is liable to a civil penalty if the supplier:

- fails to apply for an account within the given time period (see [Chapter 6](#)) after that person becomes obligated under the mandate;
- has not wholly discharged the obligation and not paid the buy-out amount;
- has not taken reasonable steps to ensure that the information or evidence provided is accurate when applying for an account, responding to the Administrators request for further information, submitting claims and sustainability reports, or disputing a revocation of certificate; or
- has become aware that information is inaccurate but has not notified the Administrator within 20 working days or not taken reasonable steps to investigate inaccuracies.

The infringements above follow those set out in RTFO legislation, which we do not see any reason to diverge from. Should the Administrator deem it necessary to issue a civil penalty, it will do so by written notice.

We propose to issue two different penalties:

- where an account holder has gained, or attempted to gain, one or more certificates by contravening one of the above bullets, the penalty will be proportionate to the buy-out price of that certificate; and
- where an account holder has made any other infringement, a fixed penalty will be issued plus a daily cost for each day the issue has not been rectified or the penalty paid in full will apply thereafter.

This approach is in line with the RTFO, as well as the UK ETS and CORSIA where offsetting or monitoring, reporting and verification (MRV) penalties are issued. It is necessary that the civil penalties are proportionate to the infringement and comparable to similar policy mechanisms, while also acting as a strong enough deterrent.

The RTFO currently issues a penalty of two times the buy-out price for each certificate where the infringement relates to gaining a certificate. The penalty will need to be at least the value of the buy-out price in order to be a deterrent, we recognise that the buy-out price in the SAF

mandate would be approximately 25% greater than in the RTFO if the proposed buy-out price was adopted, therefore the overall penalty would be greater should we adopt the same approach. We are therefore seeking comments on which of the following penalties would be appropriate (assuming a standard SAF buy-out price of £2,567 per tonne and £3,525 per tonne for PtL):

- 1.5 x buy-out price = £3,850 per tonne of standard SAF; £5,287 per tonne of PtL;
- 2 x buy-out price (**preferred option**) = £5,134 per tonne of standard SAF; £7,050 per tonne of PtL; and
- 3 x buy-out price = £7,701 per tonne of standard SAF; £10,575 per tonne of PtL.

Relating to other infringements, the RTFO issues a fixed penalty of £50,000, which is the same as first introduced in 2008. Given the relative cost of SAF, higher proposed buy-out price and impact of inflation, we consider that a proportionate penalty would be greater than the current RTFO penalty. We therefore ask stakeholders to provide comment on the following options:

- £50,000 - in line with the RTFO
- £65,000 – approximately 25% higher to reflect the difference between the proposed SAF mandate buy-out price and RTFO development fuel buy-out price
- £100,000 – double the value of the RTFO penalty

In addition to this, the RTFO applies a daily 5% increase to the penalty for every day that it is not paid in full, starting on the day following the issue of the penalty. **We propose to adopt this same approach.**

We propose that any objections to civil penalties will follow the current process in the RTFO. Should a supplier object to a civil penalty via electronic system or other means, it must be within 28 days of the supplier receiving the penalty notice. The Administrator will then have a further 28 days to alert the supplier of the outcome of the objection.

CONSULTATION QUESTION

Q59: Do you agree or disagree with the reasons for receiving penalties and the approach to issuing penalties?

Q60: Which penalty values do you consider to be high enough to be a deterrent but proportionate to the infringement?

Public sector equality duty

The Public Sector Equality Duty (PSED) came in to force in April 2011 (s.149 of the Equality Act 2010) and public authorities are now required, in carrying out their functions, to have due regard to the need to achieve the objectives set out under s149 of the Equality Act 2010.

In this regard, an initial assessment has identified that, as a consequence of our proposals, if the cost of SAF is partially or fully passed on to passengers, aviation ticket prices may increase over time. We are interested in understanding the level of extent to which a potential ticket price increase may disproportionately affect those with protected characteristics, so we can continue to mitigate such impacts as SAF policy is implemented.

To support a robust PSED assessment informed by evidence, we invite comment on how the proposed SAF mandate may impact equality and how it could achieve the objectives set out under s149 of the Equality Act 2010 to:

- eliminate discrimination, harassment, victimisation and any other conduct that is prohibited by or under the Equality Act 2010;
- advance equality of opportunity between persons who share a relevant protected characteristic and persons who do not share it;
- foster good relations between persons who share a relevant protected characteristic and persons who do not share it.

What will happen next

A summary of responses and government response, including the next steps, will be published on the DfT website. Paper copies will be available on request.

If you have questions about this consultation, please contact:
LowCarbonFuel.Consultation@dft.gov.uk

Glossary

ASTM	American Society of Testing and Materials
avgas	Aviation gasoline
avtur	Aviation turbine fuel
BAU	Business as usual
CBA	Cost benefit analysis
CCUS	Carbon capture, utilisation and storage
CI	Carbon intensity
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DAC	Direct air capture
DEF STAN	Defence Standard
EU RED	EU Renewable Energy Directive
GGR	Greenhouse gas removal
GHG	Greenhouse gas
HEFA	Hydroprocessed esters and fatty acids
LCHS	Low carbon hydrogen standard
NDF	Nuclear derived fuel
PtL	Power-to-liquid
RCF	Recycled carbon fuel
RFNBO	Renewable fuel of non-biological origin
RTFO	Renewable Transport Fuel Obligation
SAF	Sustainable aviation fuel
UCO	Used cooking oil
UK ETS	UK Emissions Trading Scheme
UKRI	UK Research and Innovation

Annex A: Summary of consultation questions

For each of the following questions, please set out the reasons for your answers, including the impacts of any alternative that you may propose and any anticipated implications. Please also provide any supporting evidence you may have.

Targets and price support for SAF

Q1: Which 2025 target option strikes the right balance between ambition and deliverability? Do you have any evidence to support your position?

Q2: Would you find it acceptable if the trajectory from 2025 to 2030 was set at an ambitious level and this led to high levels of buy-out and increasing costs to consumers?

Q3: Do you have any comments on the post 2040 proposal to legislate for targets continuing at the 2040 level, with the plan to update these when better data is available?

Q4: What increasing trajectory to 2040 do you think strikes the right balance between ambition and deliverability? Do you have any evidence to support your position?

Q5: Do you have an alternative trajectory option you would prefer to see, and do you have evidence to support this?

Q6: Would you find it acceptable if the trajectory from 2030 onwards was set at an ambitious level and this led to high levels of buy-out and increasing costs to consumers?

Q7: Do you agree with where we have set our HEFA cap upper and lower bounds (upper bound is highest HEFA uptake modelled under the mandate, lower bound is no HEFA in the mandate)? Do you have any evidence to support this?

Q8: Do you agree that we should try to limit the diversion of feedstocks from difficult-to-decarbonise road transport modes, as much as possible?

Q9: At what level do you think a HEFA cap should be set to balance mandate deliverability with road transport decarbonisation?

Q10: At what level do you think a PtL mandate should be set to strike the right balance between ambition and deliverability? Do you have any evidence to support your choice, in

particular considering low carbon electricity and hydrogen production, as well as carbon capture requirements?

Q11: In which year do you think it would be most appropriate for a PtL mandate to start and how quickly do you think ambition should ramp up?

Q12: Do you agree or disagree with the proposed use of the medium buy-out price of £2 per litre or £2,567 per tonne for the main mandate, and do you have any evidence to support your response?

Q13: Do you agree or disagree with the proposed use of the medium buy-out price of £2.75 per litre or £3,525 per tonne for the PtL mandate, and do you have any evidence to support your response?

Q14: Do you agree or disagree with the proposal that a buy-out mechanism should be a permanent feature of the mandate?

Q15: Do you agree or disagree with the information we could include in our reviews? Is there anything you feel we haven't considered but should?

Q16: Do you agree or disagree with our proposed flexible approach to review timelines?

Eligible fuels and sustainability criteria

Q17: Do you agree or disagree that low carbon avgas, low carbon ammonia and low carbon hydrogen aviation fuel, should be eligible for incentives without being subject to obligation providing they meet the sustainability criteria?

Q18: Do you agree or disagree that the definition of aviation fuels should include relevant technical specifications?

Q19: Do you agree or disagree with the proposed definition of HEFA? If not, please provide an alternative definition.

Q20: Do you agree or disagree with the proposed definition of fuels that will be eligible for PtL certificates to be redeemed against the PtL obligation?

Q21: Do you agree or disagree that the SAF mandate should adopt the criteria concerning additionality for RFNBOs that aligns with the RTFO?

Q22: Do you agree or disagree that additionality rules should be introduced for nuclear power that follow the same principles as those currently applied to RFNBOs in the RTFO?

Q23: Do you agree or disagree that, where hydrogen is used as a feedstock, eligibility should be limited to biohydrogen derived from wastes or residues and electrolytic hydrogen derived from renewable and nuclear power (when legal powers allow)?

Q24: Do you agree or disagree that the contribution of energy content from hydroprocessing should be calculated?

Q25: What level should the maximum carbon intensity threshold be set to maintain high sustainability credentials while ensuring enough flexibility to allow a wide range of SAF to be developed? Please provide evidence to support your answer.

Q26: Do you agree or disagree that the minimum carbon intensity reduction should be increased over time? If so, how should it evolve?

Q27: Do you agree or disagree that the GHG methodologies used in the RTFO should be adopted in the SAF mandate?

Q28: Do you agree or disagree that only disaggregated default values will be provided for downstream emissions while the rest of the SAF lifecycle will require the use of actual GHG values?

Q29: Please provide evidence to inform which default values should be provided by DfT for downstream emissions.

Q30: Do you agree or disagree that upstream and operational emissions should be included for nuclear power generation at the point of delivery? If yes, please provide evidence of what figure could be used for the default value.

Involved parties

Q31: Do you agree or disagree that the Secretary of State should be the Administrator, with responsibility delegated to a DfT administration unit?

Q32: Are there any additional powers or duties beyond those outlined above that the Administrator should be granted?

Q33: Do you agree with the assessment time for avtur being set at the duty point? Please provide evidence to support alternative approaches.

Q34: Do you agree that the duty point is the most suitable assessment time for renewable avgas?

Q35: Do you agree that the point of retail sale is the most suitable assessment time for hydrogen? Please provide evidence to support alternative approaches.

Q36: Do you agree with the end point of the chain of custody being the 'point of no return' of the relevant fuel?

Q37: Do you agree with the use of a 370 tonne (approximately 450,000 litre volume) threshold under which conventional avtur is not obligated within the mandate? If not, please provide an alternative and any evidence to support this.

Calculating the obligations and certificate reward

Q38: Do you agree or disagree that the obligation period should run for a one-year period and on a calendar year basis?

Q39: Do you agree or disagree with dates for which actions must be completed following the end of the obligation period?

Q40: Do you agree or disagree that the calculation of each supplier's obligation to supply SAF should be determined on the basis of energy?

Q41: Do you agree or disagree with the calculation of certificates set out above?

Q42: Do you consider there to be any potential issues with fraud adopting a continuous approach compared to a banded approach?

Q43: Do you agree or disagree with the calculation of the carbon intensity factor?

Q44: Is 26.7 gCO₂/MJ an appropriate assumption for the average carbon intensity of SAF? Please provide any available evidence if suggesting an alternative value.

Q45: In your view, should GHG reductions from CCS be rewarded under the SAF mandate? If so, should the reward extend to net negative emissions (i.e. less than 0 gCO₂e/MJ on a lifecycle basis), or should these be supported by an alternative GGR policy or a combination of policies?

Q46: Do you agree or disagree with the steps taken by the Administrator and the supplier to discharge the obligation at the end of a period?

Q47: Do you agree or disagree with the approach to calculating the HEFA cap?

Q48: Do you agree or disagree with the approach to paying the buy-out amount when a supplier does not wholly discharge its obligation?

Submitting claims and reporting and fulfilling obligation

Q49: Do you agree or disagree with the approach to creating and closing accounts?

Q50: Do you agree or disagree with the approach to submitting claims?

Q51: Do you agree or disagree with the approach to reporting, demonstrating compliance with and verifying the carbon and sustainability information?

Q52: Do you agree or disagree that the Administrator should validate fuel amount information?

Q53: Do you agree or disagree to the powers granted to the Administrator to validate fuel amounts where information is not checkable against HMRC data?

Q54: Do you agree or disagree with the approach to transfer of certificates?

Q55: Do you agree or disagree that excess certificates can be used to fulfil the obligation in the following period? If so, do you agree or disagree with the proportion of the obligation that the excess certificates can fulfil?

Q56: Do you agree or disagree that excess PtL certificates can be used to fulfil the main obligation?

Interactions with other domestic and international policy

Q57: Do you agree or disagree with the proposed approach to align mandate multiple incentives rules as much as possible with the RTFO?

Q58: Does the risk of tankering as a result of the SAF mandate justify the introduction of a minimum uplift requirement? Please provide supporting evidence if available.

Enforcement

Q59: Do you agree or disagree with the approach to revoking certificates?

Q60: Do you agree or disagree with the reasons for receiving penalties and the approach to issuing penalties?

Q61: Which penalty values do you consider to be high enough to be a deterrent but proportionate to the infringement?

Calls for evidence:

1. We welcome any further evidence on feedstock availability for SAF production. In particular, any evidence which takes into account:

- The feedstock availability worldwide required to meet planned SAF production, and competing demands with other sectors
- The need for feedstocks in other sectors and the GHG emissions savings and cost impact that any displacement could have
- Evidence from producers on any feedstock agreements they have and the amount of feedstocks they may have access to.

2. The Department would welcome data from respondents to improve the evidence base used to calculate the appropriate HEFA cap level, such as data on the availability of feedstocks for HEFA and the rate of deployment of technology globally.

3. The Department would welcome data from respondents to improve the evidence base used to calculate the appropriate buy-out price, such as price data and/or projections of cost per tonne of SAF produced for different technologies.

4. The Department would welcome evidence on the use of blue hydrogen in SAF production:

- Existing industry plans to use blue hydrogen in SAF production
- How the capital and operational costs of blue hydrogen compares to proposed eligible hydrogen production routes and the impact this would have on the price of SAF
- How the use of blue hydrogen versus proposed eligible hydrogen production routes will impact production capacity and whether eligibility of blue hydrogen is required to meet UK SAF targets
- How the use of blue hydrogen versus proposed eligible hydrogen production routes will impact lifecycle carbon intensity of resultant SAF

5. The Department would welcome evidence of any circumstances in which the proposed assessment time for avtur could cause compliance challenges.

6. The Department would welcome evidence of the impact of CCS on lifecycle GHG savings that can be achieved by SAF, including the potential for negative emissions.