SUSTAINABLE AVIATION
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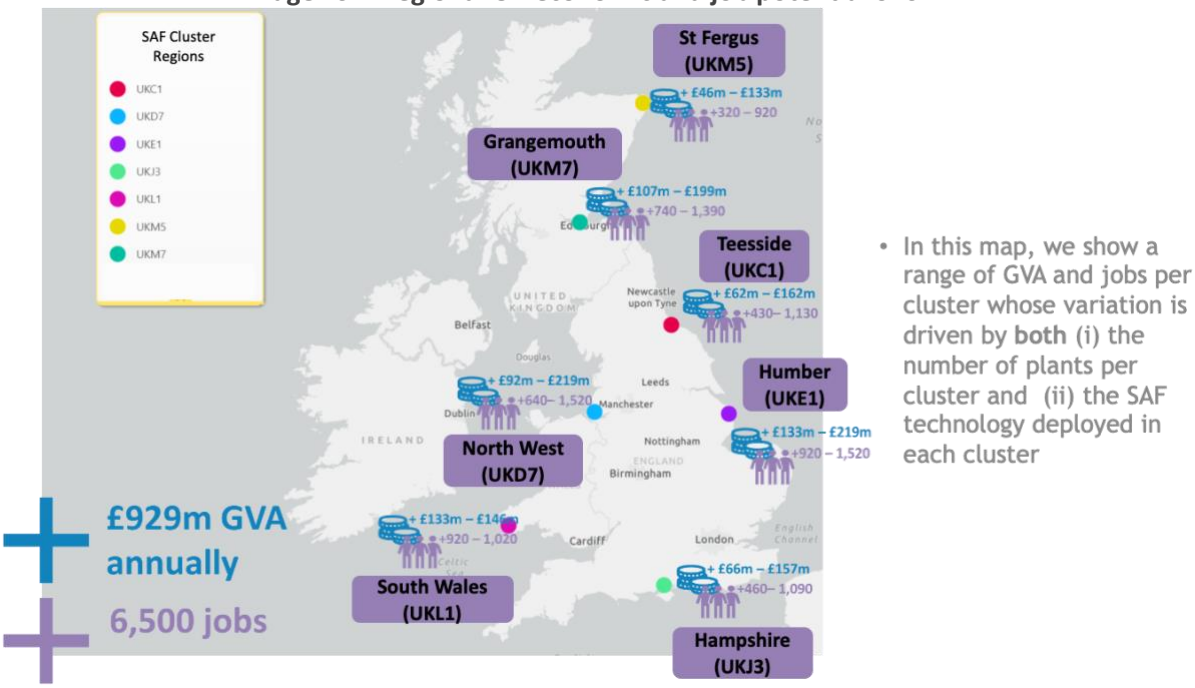
Sustainable Aviation | Comprehensive Spending Review Submission

September 2020

Executive summary

- Earlier this year Sustainable Aviation's (SA) members committed to net zero carbon emissions by 2050 - a world first for a national aviation body. This can be achieved by industry and Government working together to commercialise sustainable aviation fuels (SAF), invest in cleaner aircraft and engine technology, introduce smarter flight operations, and develop high-quality carbon offsets and removals.
- The upcoming Comprehensive Spending Review (CSR) is a golden opportunity for the Government to supercharge UK aviation industry efforts to deliver this ambition, and in doing so drive a green recovery and rebuild the sector following Covid-19.
- Out of all the available decarbonisation solutions, SAF is the one that is market ready and can deliver meaningful benefits over the upcoming CSR period but will not happen without additional financial support from the Government. It therefore requires urgent attention from the Government. SAF requires no modifications to existing aircraft or refuelling infrastructure and will remain an enduring low carbon solution for medium and long-haul flight.
- SA have commissioned work by energy consultancy E4tech specifically for this CSR submission which shows that by 2035, 14 SAF facilities could be built across the UK generating an annual GVA of £929m, creating 6,500 jobs and saving 3.6 million tonnes CO_2eq. per annum when fully operational. SAF investment could therefore help deliver a green recovery, creating future-proofed jobs in industrial regions where the facilities will be located, as well as in rural areas where the feedstock will be sourced.

Image ES1: Regional UK economic and job potential of SAF



- This new analysis shows these SAF facilities would be located in seven industrial clusters - in South Wales, the North West, Teesside, Humberside, St Fergus, Grangemouth and Southampton. These

sites were identified based on the availability of feedstock and enabling infrastructure such as low carbon hydrogen, the location of prospective carbon capture usage and storage (CCUS) clusters, and where existing refineries are located. This means SAF investment will help retain and create jobs in the regions, supporting the Government's levelling-up agenda.

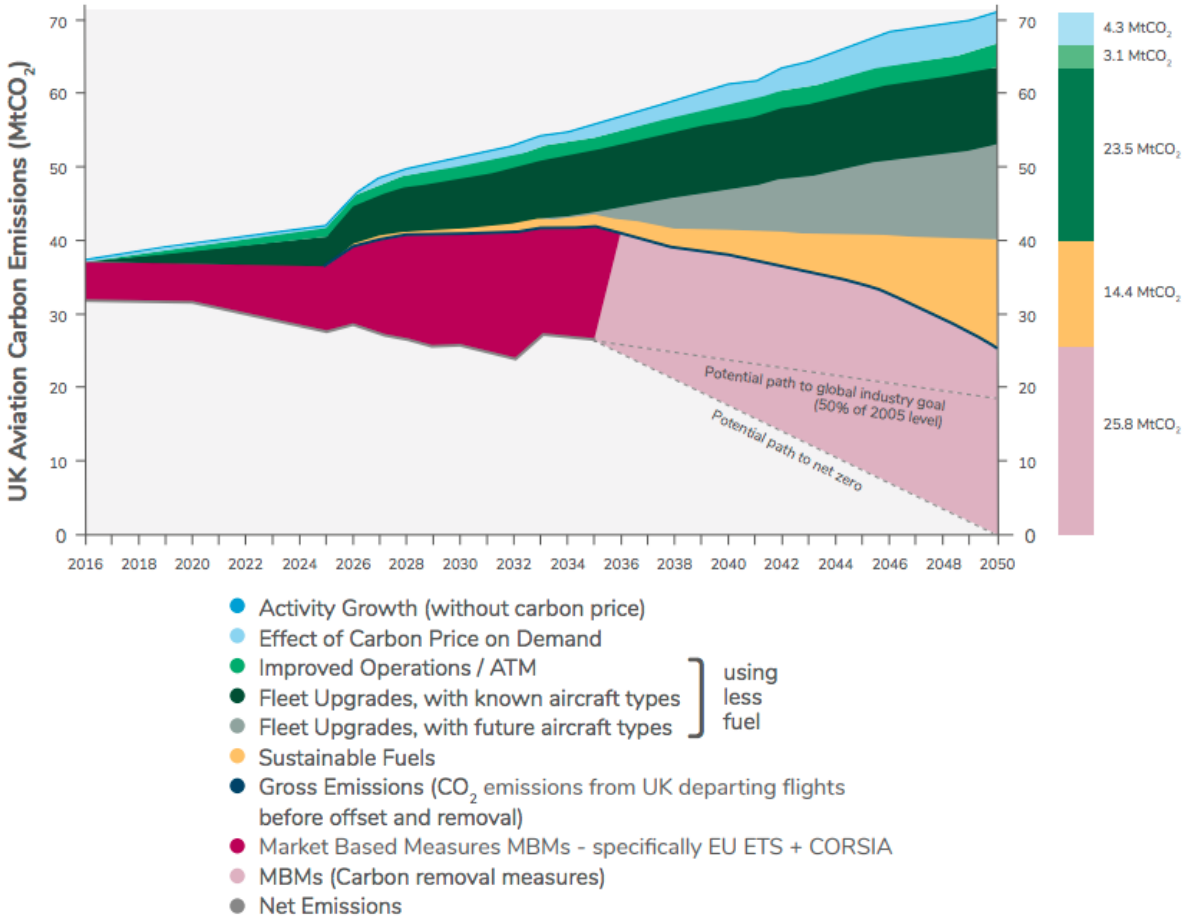
- **In addition, the export market opened up by this investment could provide up to £1.97bn of Gross Value Added and support an additional 13,700 jobs, bringing the full value to the UK of almost £3bn p.a. from both UK production and through global exports.**
- Action now will also help the UK continue its leadership on net zero by building a world leading, exportable low carbon industry of the future. SAF will become an essential fuel for the global aviation industry in a net zero world, and so the country that commercialises the technology first will capture the jobs and wider supply chain benefits. Ten years ago, the UK had the opportunity to do this with offshore wind but didn't move fast enough which meant other countries established manufacturing hubs and the UK was left to import the equipment.
- If Government action isn't accelerated over the upcoming CSR period, the UK will be left behind again which would be a huge missed opportunity given the inherent geographical and industrial advantages we have over other nations when it comes to SAF production and expertise.
- **The Treasury should commit £500m of Government funding over the forthcoming CSR period to support SAF commercialisation and R&D**. This is broken down into:
  - £429m in Government-backed loan guarantees for first of a kind SAF facilities.
  - £50m in grants and development support for SAF technologies across TRLs (technology readiness levels) 3-8; and
  - £21m to establish a UK clearing house to enable SAF testing.

About Sustainable Aviation

SA is the coalition of UK airlines, airports, aerospace manufacturers and air navigation service providers committed to cutting aviation's environmental impact and building a world leading aviation sector.

In February 2020, **SA members made a public commitment to reach net zero UK aviation carbon emissions by 2050**, becoming the first national aviation body anywhere in the world to make such a pledge. A *Decarbonisation Road-Map* published alongside the pledge sets out a plan to achieve this by working with the Government to do four things: Commercialise sustainable aviation fuels (SAF); invest in cleaner aircraft and engine technology; introduce smarter flight operations; and develop high-quality carbon offsets and removals. Image 1 below shows how emissions will be delivered between now and 2050.[1] A *SAF Road-Map* was also published which sets out in further detail the specific role SAF could play in cutting aviation emissions.[2]

Image 1: Graphic showing how emissions savings will be delivered between now and 2050[3]



There is no 'silver bullet' to delivering net zero emissions. Multiple pathways will be required with sustainable aviation fuels and improved operations offering immediate solutions.

[1] Sustainable Aviation, Decarbonisation Road-Map

[2] Sustainable Aviation, SAF Road-Map

[3] Sustainable Aviation, Decarbonisation Road-Map, p5

Context

It's no secret that aviation is one of the hardest to decarbonise sectors of the economy so comprehensive, early action to deliver this is essential if UK aviation – a great British success story as the third largest aviation network in the world – is to remain globally relevant as we move to a net zero world.

We therefore welcome the Government's support for aviation decarbonisation to date - the recently formed Jet Zero Council will coordinate action between Government and industry in this space, and the Prime Minister's goal of developing an aircraft capable of a net zero Transatlantic flight within a generation is something the industry is committed to delivering.

Building on this recent progress and these positive commitments, the Government now has a golden opportunity to ensure the CSR supercharges aviation industry efforts to reach net zero, and in doing so drive a green recovery and rebuild the sector.

The priority must be on opportunities that maximise the ability to reduce carbon emissions from aviation. To get this right it is important to understand where UK aviation carbon is generated to determine the best opportunities to accelerate progress. Images 2 and 3 below show that the majority of UK aviation carbon emissions come from medium to long haul flights.

Image 2: Contour map of UK aviation emissions in Europe

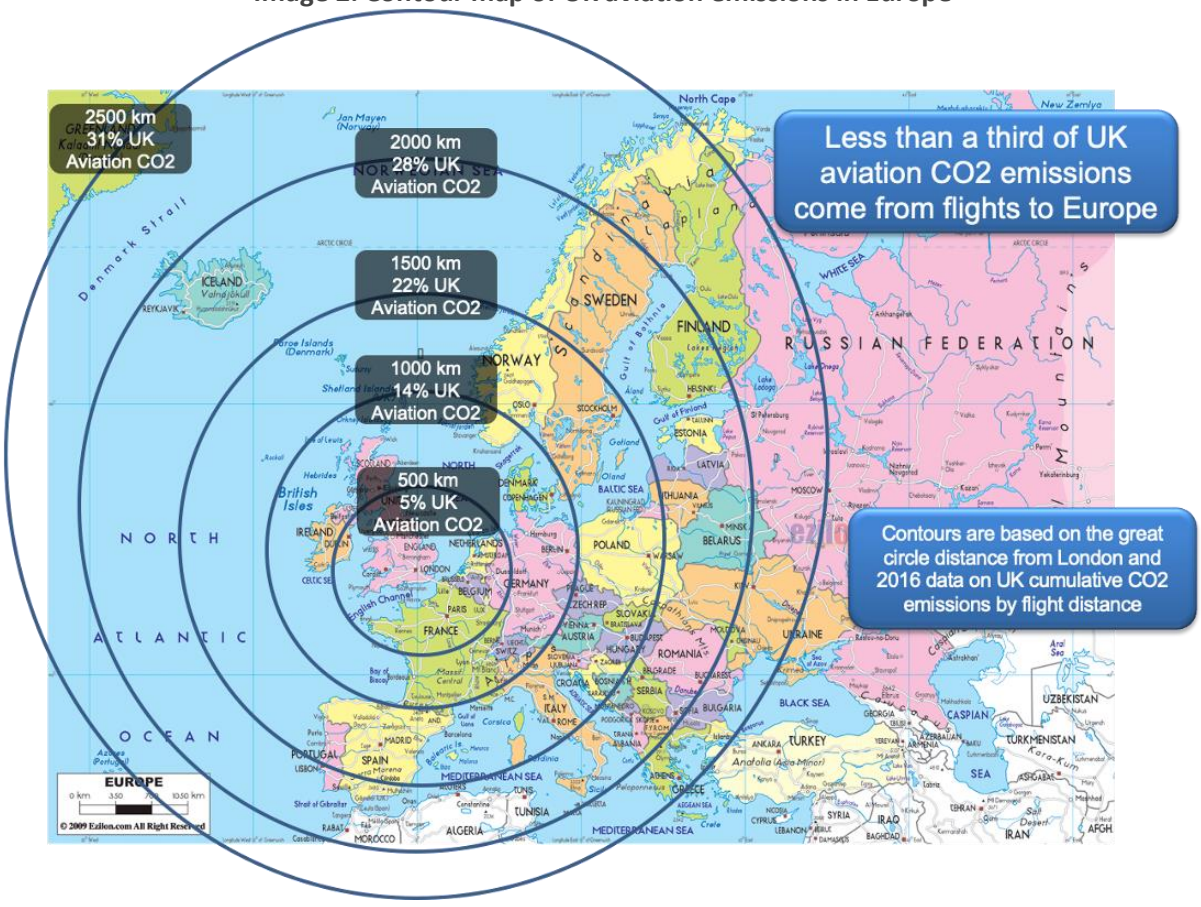
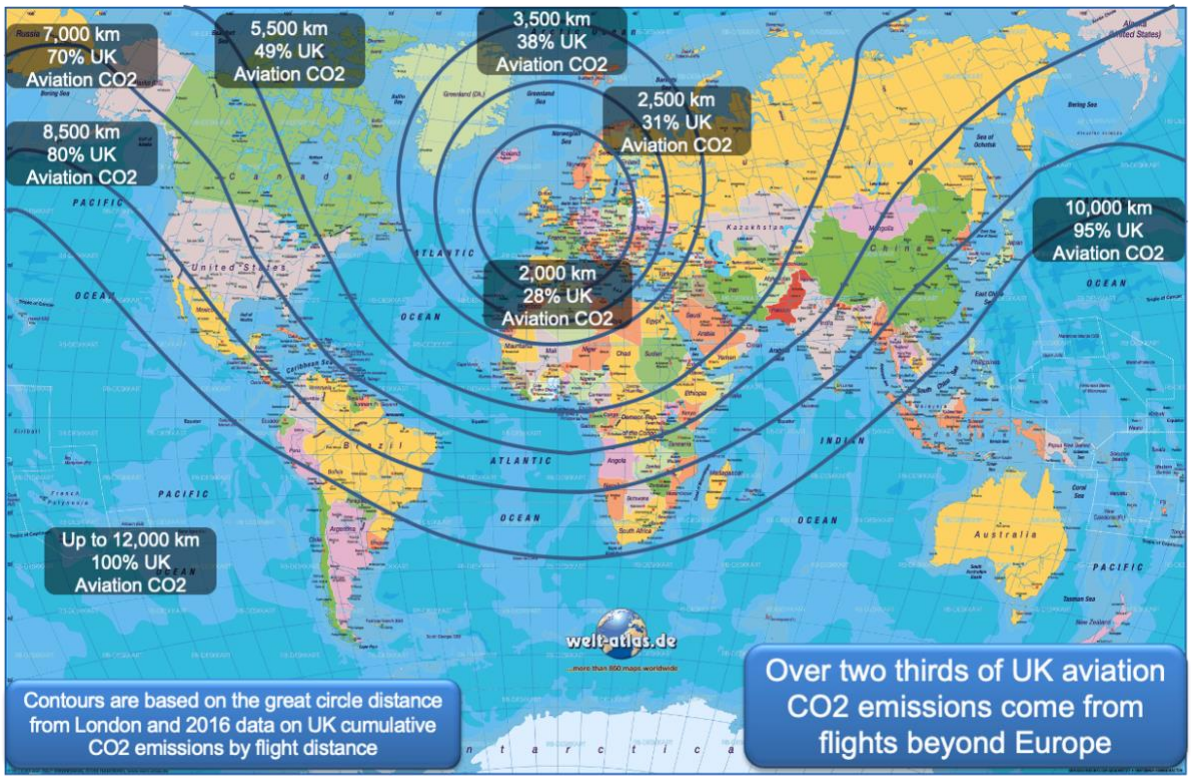


Image 3: Contour map of UK aviation **emissions across the world**



Out of all the available decarbonisation solutions, the one that is market ready and can deliver meaningful benefits over the upcoming CSR period - and therefore requires urgent attention from the Government - is investment in SAF. This is because SAF is a near-term opportunity, deploying proven technologies, it can be used in existing engines and transportation pipelines requiring no modifications to aircraft or refuelling infrastructure, has the potential to deliver meaningful carbon savings *this decade* and saving 3.6 million tonnes CO_2eq. per annum by 2038. SAF is also the best long-term option for decarbonising long-haul flight as Image 4 below shows.

SA recognises that there is an active debate about the merit of focusing on accelerating the introduction of electric or hydrogen powered aircraft above investing in other solutions. SA believes electric and hybrid, hydrogen and SAF will all be needed to ensure aviation can deliver on the net zero emission potential set out in our Road-Map.

Electric, hybrid and hydrogen technologies have great potential to deliver zero emission short to medium haul flights. Considering the latest scientific understanding[4], these technologies do have limitations on aircraft range. There are also infrastructure considerations (such as refuelling or recharging at take-off and landing destinations and any safety related diversion airports) that require further work and investment in ground facilities. Overcoming these challenges will take time and therefore new electric or hydrogen aircraft are forecast to take at least a decade to come to market and start to play a significant role in decarbonising flight.

However, work is ongoing, such as the ATI's FlyZero project[5] and the UK E2E Hydrogen Study[6], to understand the potential, limitations and industrialisation considerations of these future

[4] Taken from the McKinsey May 2020 Hydrogen Powered Aviation report to the EU Clean Sky 2 and Fuel Cells and Hydrogen 2 joint undertakings
[5] Announced in July 2020 - https://www.ati.org.uk/events-media/news-blog/ati-launches-flyzero-initiative/
[6] See https://www.gov.uk/government/publications/business-models-for-low-carbon-hydrogen-production

technologies; the UK Aerospace industry is seeking a significant uplift in R&D funding to accelerate the maturation of such technologies. Image 5 confirms, that despite any technology uncertainty at present, SAF provides the solution for as long as needed for the medium to long haul routes, starting immediately, and conveys the broad industry consensus that an alternative liquid (kerosene-like) fuel will be needed to decarbonise the longest routes for the foreseeable future.

Image 4: Graphic showing the range of SAF and electric / hydrogen flight by 2035

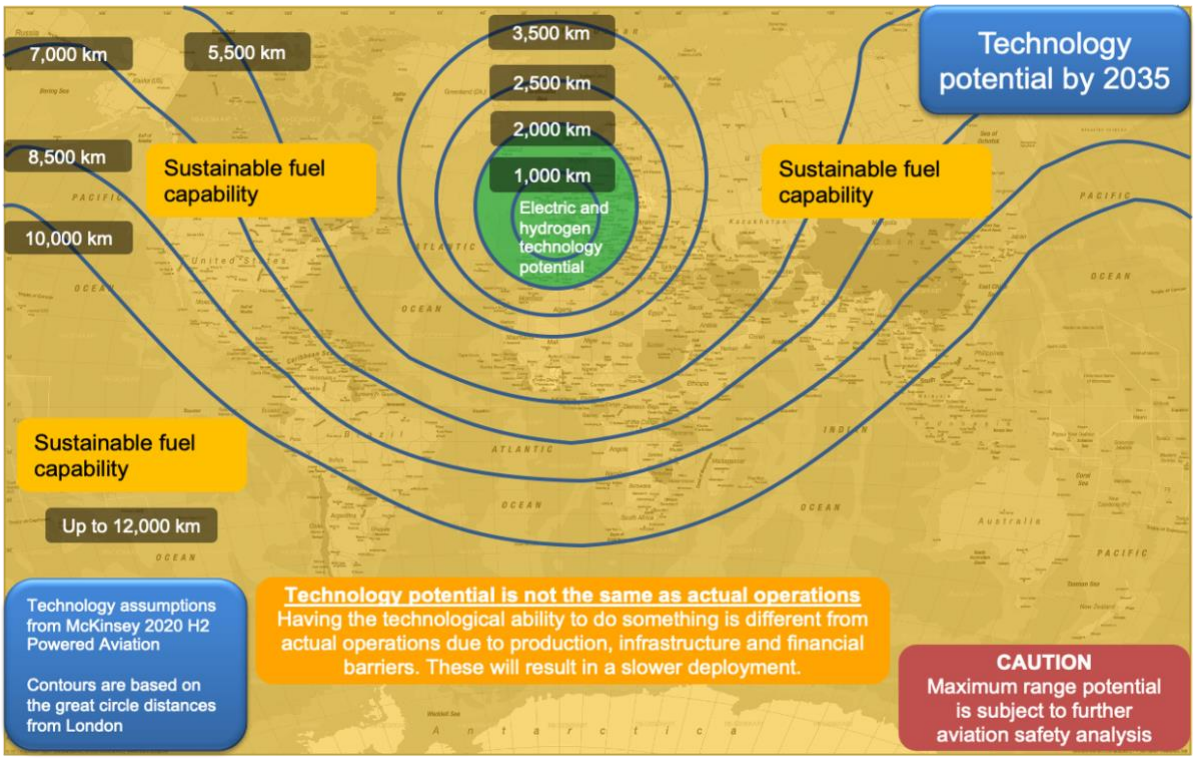
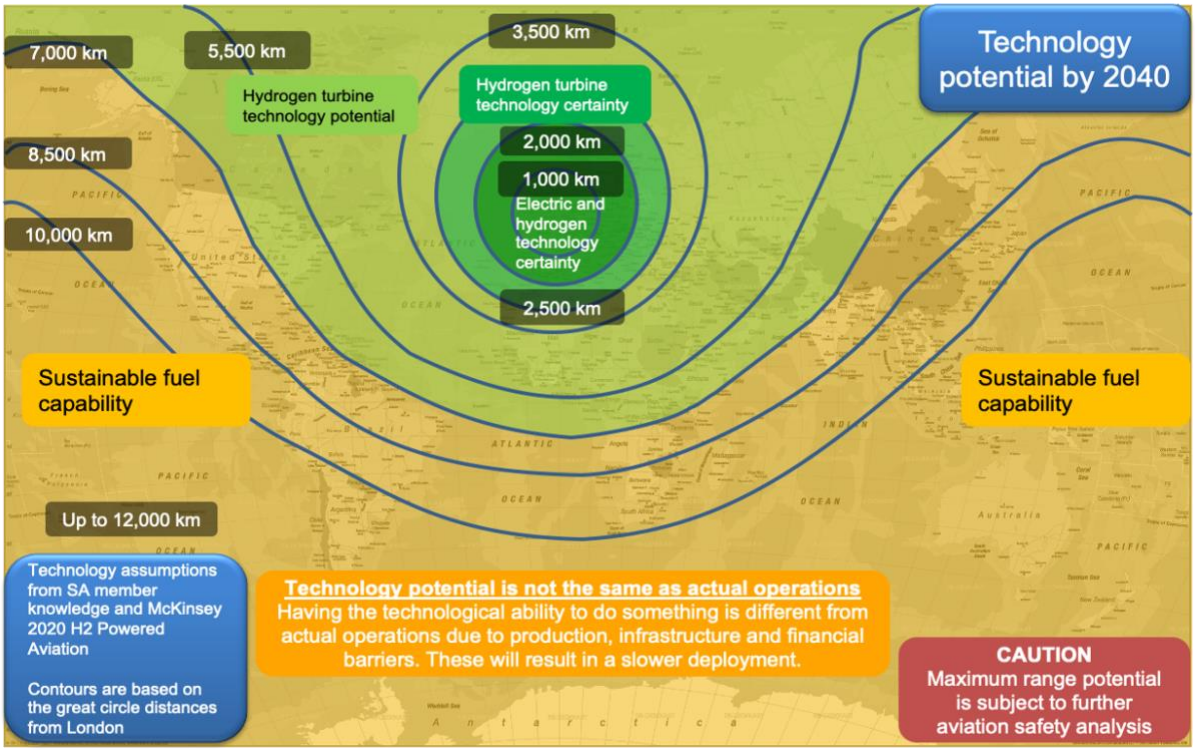


Image 5: Graphic showing the range of SAF and electric / hydrogen flight by 2040



Advanced waste-based SAF (which is what we refer to as SAF in this document) is developed using a range of different, and crucially sustainable feedstocks - from waste oils, fats, greases, industrial gases, municipal solid waste and agricultural and forestry residue. These are converted via industrial processes into a fuel that directly replace kerosene and deliver at least 70% of lifecycle carbon savings. This differs from first-generation SAF which rely on unsustainable feedstocks like food crops - feedstocks that should be used for other purposes and can lead to significant land use change.

Given these benefits, we have focused this submission on policy support for SAF. In short, **we are calling for £500m of Government funding over the forthcoming CSR period to support SAF commercialisation and R&D**. Further detail on this ask is detailed below, which breaks down how the £500m is distributed:

- **£429m in Government-backed loan guarantees for first of a kind SAF facilities:** These loan guarantees will help establish the UK as global leaders in SAF and kick start SAF production in the UK. This funding will support the establishment of the first flagship SAF facilities in the UK to unlock the wider potential. First-of-a-kind SAF facilities are very hard to finance. Conventional bank debt is therefore not available, or if it is available it is offered at prohibitively high cost. A Government loan guarantee scheme that is tailored to meet the needs of emerging SAF technologies (covering a proportion of the total capital required) would unlock private finance to fund the first commercial scale facilities.

- **£50m in grants to help SAF technology providers transition from lower TRLs (3-6) and to support providers at higher TRLs to move to commercial scale**: The UK is presently losing out to other countries that provide greater support and grant funding. Fully exploiting the network of UK expertise will enable the UK to showcase cutting edge facilities, creating a network of flagship SAF production facilities and provide a clear path to commercialisation.

- **£21m to establish a UK clearing house to enable SAF testing:** This remains one of the major barriers to new fuel supply chains. Aviation fuels need rigorous testing to ensure they meet the safety and quality standards for aviation and the UK is home to some of the foremost experts in fuel testing and approval. Funding to support early stage developers will attract many more fuel developers to the UK and help anchor new investment.

SAF is an essential component of the net zero transition. However, as the SA Decarbonisation Road-map clearly shows, there is no silver bullet. To reach net zero by 2050 industry needs to invest in a wide range of measures - including cleaner aircraft technology and smarter flight operations. This includes hydrogen and electric flight which will play a role in decarbonising short and medium-haul flight as Image 4 and 5 above shows. These new technologies need to be economically viable in addition to technically viable, requiring infrastructure modifications, and additional policy support to ensure their future success - we have detailed additional policy requirements for areas beyond SAF that will help deliver this later in this paper.

The subsequent section outlines how co-ordinated action to support SAF commercialisation from both Government and industry will contribute to achieving three of the six aims of the 2020 CSR. The final section outlines costed policy proposals that we believe need to be implemented over the forthcoming CSR period to support aviation decarbonisation.

1. "Strengthening the UK's economic recovery from Covid-19 by prioritising jobs and skills"

Aviation - as the third largest network in the world - is a crucial element of the UK's economy, playing an indispensable role in trade, exports, tourism, connectivity, and contributing over £52 billion a year to GDP. It is also one of the hardest sectors to decarbonise and hardest hit from the pandemic.

As we slowly start to return to the skies, action to decarbonise is now more important than ever to ensure the economy "builds back better" and the sector "restarts" in an improved and stronger position than before.

To do this the Government needs to support the development of essential new low-carbon aviation technologies, creating new green jobs utilising existing aerospace and refining expertise, export opportunities and new intellectual property. The UK aviation sector directly contributes 230,000 jobs, which are largely high value and highly skilled jobs in engine and airframe development and manufacturing that will be a continued requirement for the industry as it decarbonises.[7]

In particular, given the technology is market ready, investment in SAF can deliver near term economic benefits and so should be a priority for investment. It's a proven technology, with over 200,000 commercial flights already having used SAF around the world today and the UK's first commercial SAF facility, Altalto Immingham - the first of its kind in Europe - received planning permission in June (see a mock-up of the proposed facility below).[8] Other UK facilities under development include LanzaTech's LanzaJet project in Port Talbot, Wales[9].

Image 6: Mock-up of Altalto Immingham - a waste-to-SAF facility being developed by Velocys, British Airways and Shell

Independent work on behalf of SA specifically for this CSR submission conducted by E4tech shows that **by 2037 there could be up to 14 SAF production facilities in the UK** which would create **6,500 direct jobs** and **contribute £929 million annually to the UK economy**.[10] With export and overseas opportunities included, this grows to 13,600 jobs and £1.9 billion.[11] The most advanced SAF facility in

[7] Department for Transport, Aviation 2050: The future of UK aviation, p6

[8] Velocys press release, NELC formal planning permission notice issued

[9] Lanzatech press release, Virgin Atlantic and LanzaTech Celebrate as Revolutionary Sustainable Fuel Project Takes Flight

[10] New E4tech study for the CSR. Please use contact details below to request full report for further detail

[11] Sustainable Aviation, SAF Road-Map, p4

the UK - Altalto Immingham - hopes to be producing fuel by 2025 creating hundreds of construction jobs and 130 permanent jobs.

These jobs will be located predominantly in industrial heartlands that have existing chemicals and refining expertise, as is the case with Altalto Immingham. These skills are needed to build and operate SAF facilities that involve complex industrial conversion processes. The E4tech study shows that **SAF investment will generate an annual GVA of £700m and 4,900 jobs in industrial regions**[12]. Alongside SAF, these new plants will also produce other fuels and chemicals and these products contribute a further £460m GVA per annum and 3,200 jobs.

However, SAF production also has the potential to generate jobs and spur economic activity in rural areas where feedstocks for facilities will be processed before final upgrading at an industrial hub. Producing feedstocks locally can harness the growth of the agricultural sector for broader rural development, while not affecting food production. In addition, processing wastes and residues locally provides high-skilled, high value chemical engineering jobs across the UK. The E4tech study shows that SAF investment will generate an annual GVA of £229m and 1,600 jobs in rural areas. [13]

Further UK economic and job opportunities will arise from the ability to export SAF skills and expertise beyond the UK. The table below summarises this potential as well as the overall combined opportunity.

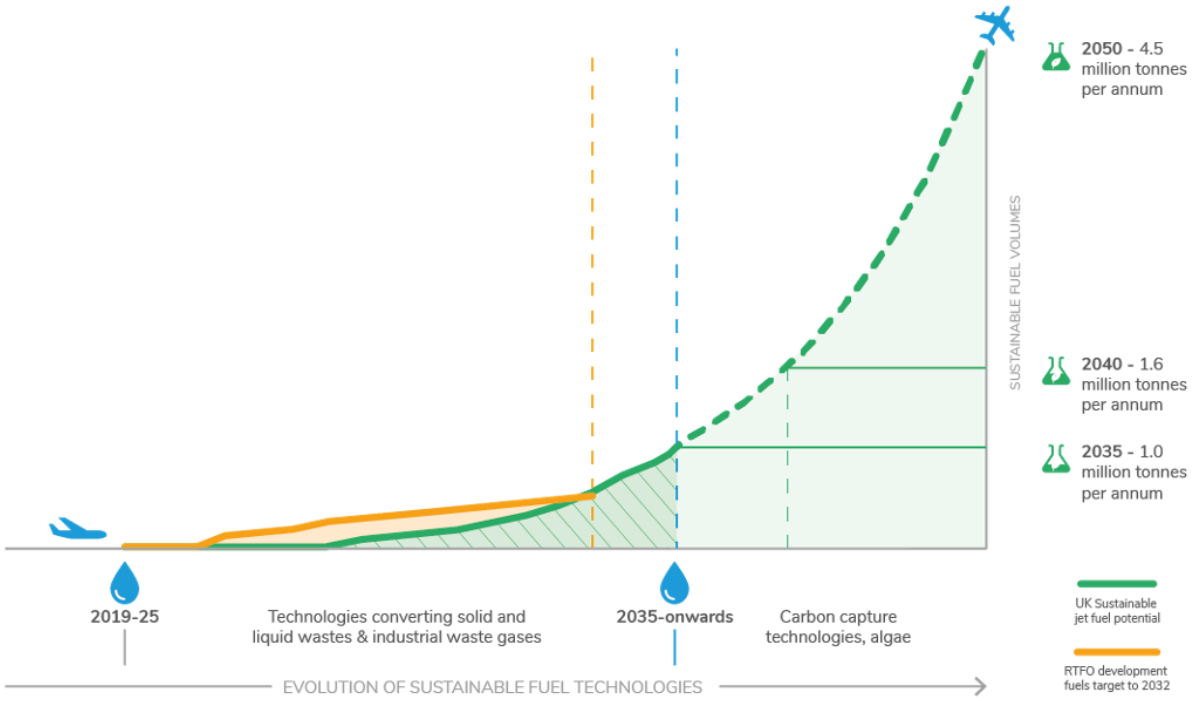
	UK SAF production benefit*	UK SAF export benefit**	Combined SAF UK production and Export benefit
GVA (per annum)	£929m	£1,970m	£2,899m (or £2.9bn)
Jobs	6,500	13,700	20,200

Note:
*Assumes all 14 SAF plants are operating at full capacity
**Export GVA and Jobs depend on the size of the global SAF market and the scale of UK SAF competitive advantage compared to other countries. The range predicted by E4tech varies from a GVA value of £0.9bn to £2.7bn and associated jobs from 6,500 to 18,500. We have assumed a mid-range value for presentation purposes.

Developing the UK's capability to produce SAF now will also continue to deliver returns on investment beyond 2037 as SAF production begins to migrate from waste-to-fuel methods to power-to-liquid methods as Image 7 shows below. This is key to enabling the 32% reduction in UK aviation carbon emissions by 2050 as outlined in SA's SAF Road-Map.

[12] New E4tech study for the CSR. Please use contact details below to request full report for further detail
[13] New E4tech study for the CSR. Please use contact details below to request full report for further detail

Image 7: Evolution of SAF technologies to 2050



2. **"Levelling up economic opportunity across all nations and regions of the country by investing in infrastructure, innovation and people – thus closing the gap with our competitors by spreading opportunity, maximising productivity and improving the value add of each hour worked"**

The E4tech study has identified seven possible SAF clusters (as Image 8 below shows) which would host the 14 production facilities mentioned above. This clearly shows how building a SAF industry will support the Government's "levelling-up" agenda by creating jobs and spurring economic activity in areas in need of investment - **South Wales, the North West, Teesside, Humberside, St Fergus, Grangemouth** and **Southampton (as Image 9 shows)**.

Image 8: Map identifying the seven potential SAF clusters with jobs and GVA potential by 2037

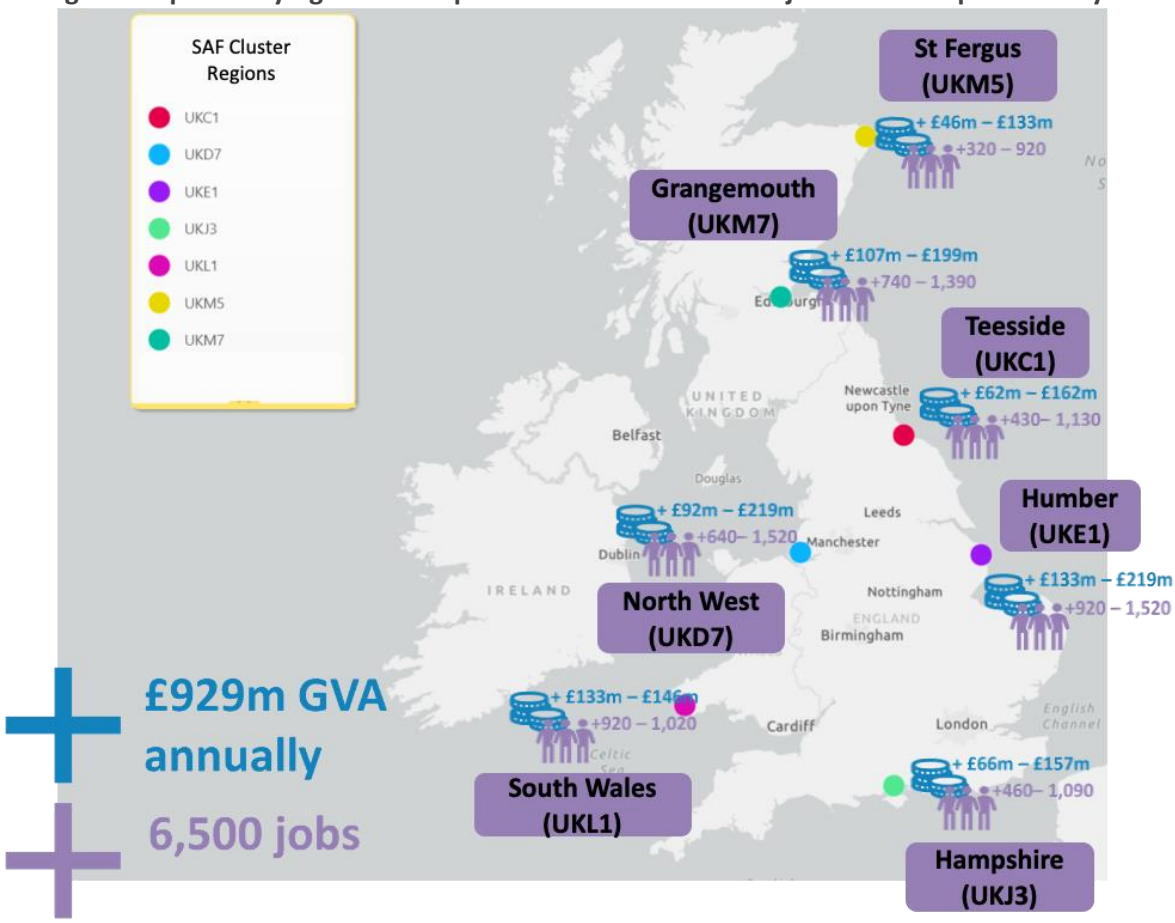
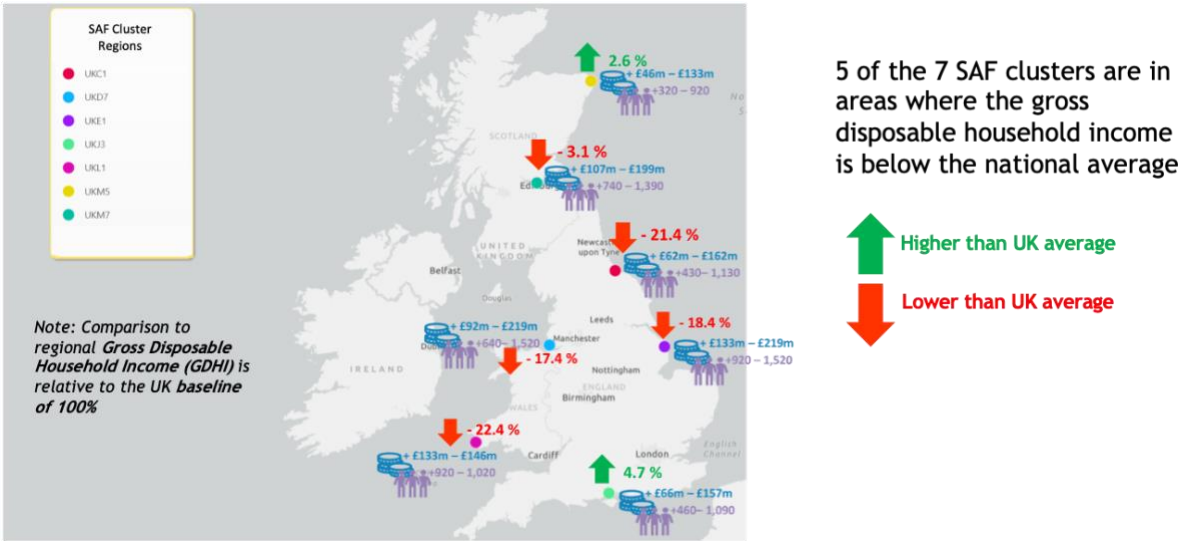


Image 9: Map of the seven potential SAF clusters in relation to Gross Disposable Household Income



These SAF clusters were identified due to several reasons which are outlined below:

- SAF facilities can use a range of feedstocks including **agricultural residues, forestry residues, municipal solid waste, industrial gases and waste fats** - these resources are located across the country so can easily supply the identified SAF industrial hubs.

- SAF facilities will benefit from utilising **existing refin.3eries and their associated infrastructure and skills** so should be focused in these areas where they can.

- Whilst SAF delivers at least 70% of lifecycle carbon savings, further savings could be made if facilities utilise **CCUS technology and infrastructure**, by capturing and storing underground the carbon produced from the conversion process itself. This could generate lifecycle carbon savings of >100% (as is the case with the planned Altalto Immingham facility) which means SAF would then become a *negative emission fuel*, an even more desirable outcome as we strive to reach net zero emissions. The planned CCUS clusters are earmarked for South Wales, the North West, Teesside, Humberside, St Fergus and Grangemouth.[14]

- SAF production could also benefit from having readily available sources of low carbon hydrogen such as **blue hydrogen** (made from natural gas through the process of steam methane reforming) located nearby. This could be used to upgrade waste products into SAF. Potential blue hydrogen clusters also directly align with the potential CCUS clusters, given the overlapping expertise, skills and infrastructure required.

- SAF production could also benefit from having readily available sources of **green hydrogen** (particularly offshore wind given the vast resource that is available in the UK) located nearby. Electricity from these wind farms could power conversion processes to upgrade waste products into SAF. Existing and planned wind capacity is located offshore from almost all of the six clusters so could benefit from dedicated connections.

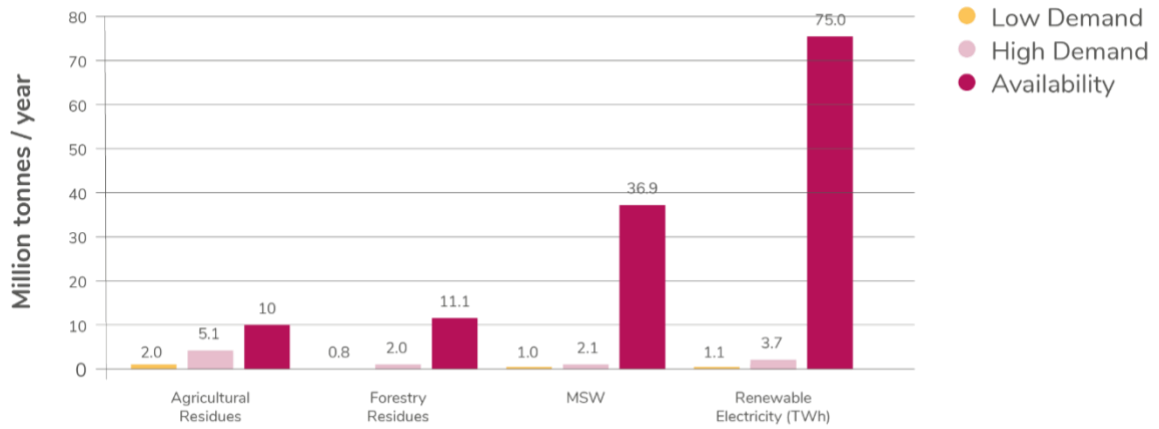
Collectively this shows how SAF production will support investment and economic activity across the UK, but particularly focused in the regions, as well as utilising existing and future industrial and green

[14] BEIS, The UK Carbon Capture Usage and Storage Deployment Pathway: An Action Plan, p16

infrastructure. There is additional synergy potential with Small Modular Reactors (SMRs) for reliable nuclear electricity which is also compatible geographically with some of the clusters in Image 5.

In addition, previous work by E4tech for SA on the availability of wastes and residues for SAF production indicated that there is sufficient feedstock to achieve the production of SAF set out in the SA 2020 SAF Road-Map[15]. Most feedstocks are not seen as constrained with the exception of waste fats, oils and greases.

Image 10: Copy of figure A1.2 - UK 2035 feedstock demand compared to availability of sustainable feedstock (from SA 2020 SAF Road-Map)



South Wales and **Grangemouth** have feedstock within the region and all required infrastructure, and therefore could be considered as attractive regions for SAF clusters. Indeed **LanzaTech**, who have been shortlisted for Government grant funding are developing plans for a commercial alcohol-to-jet SAF facility at Port Talbot, potentially utilising waste gases from Tata Steel.

Humberside (East Yorkshire and Northern Lincolnshire) and the **North West** have all infrastructure requirements but as feedstock is more abundant in nearby regions, the E4tech research assumes that the primary conversion of feedstock would occur in rural areas and intermediate products transport to the SAF clusters for upgrading. The planned **Altalto Immingham** facility is located in Immingham in North East Lincolnshire and is expected to be operational from 2025.

Teesside and **St Fergus** do not have refineries but have feedstock within their corresponding regions (Durham and Tees Valley and North Eastern Scotland), as well as access to blue and green hydrogen and CCUS capability.

[15] See pages 38-39 of SA SAF Road-Map 2020

3. "Making the UK a scientific superpower, including leading in the development of technologies that will support the government's ambition to reach net zero carbon emissions by 2050"

UK aviation is already leading the world when it comes to developing SAF and, as the section above shows, plays to our geographical and industrial strengths as a nation. Supporting the development of this industry in the CSR will ensure the UK is one of the first in the world to commercialise this technology, something that will be an essential, exportable solution across the globe in a net zero world.

We have explained above how SAF is a market-ready solution to decarbonising aviation, and can deliver 70% lifecycle carbon savings, extending to more than 100% with CCUS. The prospect of negative emission fuel for one of the hardest to decarbonise sectors of the economy is game changing, meaning SAF should play an integral role in the Government's net zero strategy. By 2038, once all 14 plants are fully operational (running at 90% capacity) it is estimated that **3.6 million tonnes CO_2eq. per annum GHG can be saved, a reduction of 73%[16].**

But beyond meeting our own carbon reduction targets, the UK is in a prime position to become a world leader in SAF production - supporting the Government's ambition to become a scientific superpower. However, other countries are moving fast in this space. France and Germany are driving and leading SAF collaborations, passing incentivisation policies and creating local targets, and Indonesia and Norway have implemented blend mandates.

Ten years ago, the UK was in a similar position with offshore wind - some promising early policy signals, an inherent geographical advantage, industrial capability, and relevant expertise in offshore oil and gas. However, the Government did not move fast enough which meant other countries established manufacturing hubs first and the UK lost out on jobs and was left to import the equipment.

The Government has started to take action to support SAF commercialisation with changes to the revenue support mechanism (the Renewables Transport Fuel Obligation), competitions to give grants to projects (like the Future Fuels for Flight and Freight Competition) and coordinating industry and Government action through the Jet Zero Council. However, if action isn't accelerated over the course of the upcoming CSR period the UK will be left behind as it was with offshore wind which would be a huge missed opportunity given the inherent advantages we have over other nations when it comes to SAF production and expertise.

The UK is well positioned to become a "SAF superpower" for the following reasons:

- The Government has established the Jet Zero Council which is a perfect forum to drive forward action in this space. The Government has also recently committed to delivering Transatlantic net zero flight "within a generation". The intent is there and supporting SAF now will help realise this vision.

- The UK has the third largest aviation network in the world and a proud history of developing and manufacturing cutting edge aircraft and engines. Building a world leading SAF industry will continue this tradition.

[16] Updated by E4tech. The CO2 savings have increased from those shared in the SA UK 2020 Fuels Roadmap which estimated GHG savings of 2.8 million tonnes CO2eq. per year in 2035. This was based on the assumption that a number of plants would be operating below normal throughput in 2035 due to being under commission.

- Altalto Immingham will be Europe's first commercial scale waste-to-SAF facility and is expected to be operational from 2025, and only the third of its kind in the world - the other two similar facilities are located in the US.

- With the UK's ownership of the global jet fuel standard 91-091 (through the Ministry of Defence), there is a particularly unique concentration of fuels expertise in the UK. This is a unique situation only matched by the US. Fuels and fuel systems experts are also based in the UK with the Airbus Centre of Competence for fuels systems located in Bristol, and other certification centres based in Derby and Solihull. This understanding and expertise can be applied to certifying SAF for use globally.

- Existing UK petroleum infrastructure could support SAF. Refineries need to move from purely fossil fuel refining to a mixture of SAF and fossil. Co-processing of these fuels can be batched or together and they will be able to use the current infrastructure to deliver SAF.

- The high and low SAF scenarios modelled require between 7% and 16% of total sustainably available agricultural residues, forestry residues and municipal solid waste. This is a higher proportion of available feedstock than the global deployment requires but is still within what could be accessible in the UK. The use of waste fossil feedstocks such as industrial gases from steel mills or refineries could further increase the total available feedstock in the UK.

CSR policy proposals

Given the significant opportunities outlined above, SA and their members have consulted widely on what policy commitments in the upcoming CSR would help build a SAF industry in the UK. This has concluded that **the Treasury should commit £500m of Government funding over the forthcoming CSR period to support SAF commercialisation and R&D**. Further detail on how this is broken down and what it would contribute to is outlined below.

£429m in Government-backed loan guarantees for first of a kind SAF facilities
These loan guarantees will help establish the UK as global leaders in SAF and kick start SAF production in the UK. This will support the establishment of the first flagship SAF facilities in the UK to unlock the wider potential.

Currently, first-of-a-kind SAF facilities are hard to finance due to technology risk, as though all components have often been demonstrated at commercial scale individually, as is the case with Velocys' Altalto Immingham project, there are no existing plants in operation for investors to evaluate risks. Conventional bank debt is therefore not available, or if it is available it is offered at prohibitive cost. As such, we believe that this project and other early stage SAF projects would be ideally suited for support through a Government-backed loan guarantee.

The existing UK Guarantees Scheme (UKGS) could be an ideal vehicle through which to issue these loan guarantees. The UKGS has only issued £1.8bn of guarantees out of a potential £40bn since 2012. The UKGS, as currently constituted as a form of "last resort" support, would only provide the necessary guarantee for an early stage SAF project if a bank would take equivalent risk alongside (thus defeating the object).

A revision to the UKGS to make available £429m of government guarantees (covering a proportion of the total capital required) to support the debt of first-of-a-kind SAF projects - with stringent due diligence but importantly without the requirement for a commercial bank to take equal risk - would unlock much needed private investment.

Crucially, this could be done without additional spending, except in cases where the guarantee is called upon to pay out. We are also open to other approaches whereby the Government can share some of the risk in establishing this strategically important industry. SA remains committed to continue working with Government beyond this initial investment to realise the full potential of the 14 SAF plants set out in this work.

£50m in grants to help SAF technology providers transition from lower TRLs (3-6) and to support providers at higher TRLs to move to commercial scale

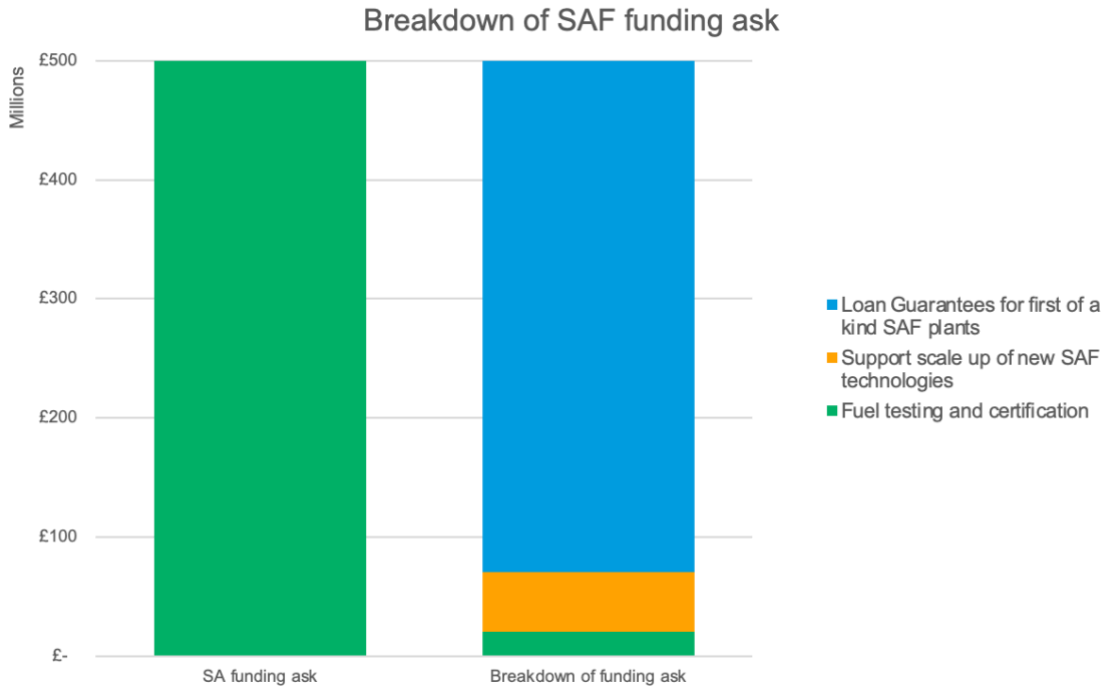
The UK is presently losing out to other countries that provide greater support and grant funding. Fully exploiting the network of UK expertise (e.g. high value manufacturing catapult) will enable the UK to showcase a number of cutting edge plants, creating a network of flagship SAF production facilities and provide a clear path to commercialisation. This will also support the development of power-to-liquid methods of producing SAF which will become more prevalent in the 2030s.

£21m to establish a UK clearing house to enable SAF testing

This remains one of the major barriers to new fuel supply chains. Aviation fuels need rigorous testing to ensure they meet the safety and quality standards for aviation and the UK is home to some of the

foremost experts in fuel testing and approval. Funding to support early stage developers will attract many more fuel developers to the UK and help anchor new investment.

It will also support UK fuel businesses to transition from the production of road transport fuels to aviation, helping to protect jobs as UK road transport electrifies.



To reach net zero by 2050 industry needs to invest in a wide range of measures - including cleaner aircraft technology and smarter flight operations - and so we have detailed below additional policy support for areas beyond SAF that will help deliver this:

- *Cleaner aircraft technology*: As Image 1 above shows, technology improvements through fleet upgrades represent the single largest "in sector" long-term aviation decarbonisation solution, even more so than SAF. SA endorses the UK aerospace request for the Aerospace Technology Institute (ATI) funding to be doubled to £330m per annum to enable the UK to become a world-leader in developing more efficient engines as well as hybrid, electric and hydrogen aircraft. Every £1 of Government investment in aerospace R&D leverages £12 in private R&D spend. The gearing should be adjusted to reflect the current difficulties the industry is facing, and the funding should be front-loaded for R&D projects that need it.

- *Smart flight operations*: The bulk of the UK's airspace is more than 70 years old and in urgent need of modernisation to make use of new aircraft performance capability, and to reduce emissions and noise. Today's advanced aircraft still rely on old navigation technologies because the airspace structures they still use were designed for the slower, fewer aircraft flying in the 1950s. This inefficiency can be solved with an airspace modernisation programme that uses readily available technology to deliver significant carbon savings in the next five years. However, the financial impact of Covid-19 has put the programme at risk meaning a key part of the UK's transport infrastructure could deteriorate further. The Airspace Change Organising Group (ACOG) has called on the Government for short term funding that would progress this through the Airspace Masterplan. Sustainable Aviation endorses this request to ensure the airspace modernisation programme stays on track.

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