Management Consultancy

Phase 1

Project Report

Achieving Price Stability for Sustainable Aviation Fuel Through a Contracts for Difference Business Model

Draft 2.1

Nic Rigby November 2021

Executive summary

This project was initiated in order to ensure that the plan to produce SAF in the UK by the mid-2020s remained on track. The project was subject to governance of the Jet Zero SAF Commercialisation workstream and focused on enabling investment in SAF production based on price stability for the fuel produced. Industry input was provided by interviewing 37 organisations from the aviation and associated sectors.

The project created traction for price support mechanisms and particularly CfDs by increasing industry knowledge of these mechanisms and their key features. Industry feedback to confirm that the key features had been properly identified and as to how those features should be managed is set out in this report.

There was a strong consensus that a CfD programme was the optimum way forward for establishing domestic SAF production. Four challenges were identified, the most material of which was a sense of urgency, i.e. that the CfD programme and SAF mandate should be implemented in parallel.

Alongside the urgency challenge the other challenges are 1) for DfT/ Treasury and Industry to work together to determine the optimum approach to funding the price stability mechanism 2) government and industry to derive an approach for strike price indexation that balances simplicity and cost to consumers and 3) government and Industry experts to ensure targets for feedstock sustainability remain appropriate throughout the CfD contract period.

In relation to all other factors investigated industry provided a strong consensus as to how these factors should be managed. Therefore, if DfT are also supportive of the approach then they should indicate a "minded to" position and expect appropriate industry support.

The next steps are for DfT to determine whether and when a consultation re price stability would be appropriate and for industry to initiate phase 2 of this project which would be to support DfT by means of a secondment in making that consultation happen and thereby bring the reality of UK SAF by the mid-2020s closer. If SAF production is to begin in 2025 construction needs to begin 2 years earlier and a price support mechanism in place by the end of 2022.

Contents

1. Introduction

1.1 Background to the study

The study came about due to discussions within the industry body, Sustainable Aviation around the need to develop a price stabilisation mechanism for Sustainable Aviation Fuel (SAF). The lack of such a mechanism is widely recognised as the main reason for there being no SAF production plants that have advanced beyond the planning stage in the UK. This resulted in the first draft of the Terms of Reference see 1.2 for final draft. Four members of Sustainable Aviation, Gatwick Airport, International Airlines Group, Rolls Royce and Velocys, agreed that they would fund the study and would work with DfT as Sponsors of the project. It was also decided that governance of the project be established through the SAF Commercialisation Workstream of the Jet Zero Council. This was agreed on 20 August 2021 and the Terms of Reference agreed as in 1.2 below.

1.2 Terms of reference

Outline Proposal for developing a price support mechanism for Sustainable Aviation Fuels v3.1

Revisions in this document have been captured as part of the JZC SAF DG Commercialisation subgroup meeting held on August 20th, 2021. Questions and Answers from that meeting are included as Appendix A2.

1. Goal: reaching net zero aviation
    a. Establishing a SAF industry in the UK will give the UK some fuel security and create an economic boost.
    b. Some combination of obligations and price support mechanism(s) will be required.
    c. Funding mechanism will need to involve payment by users, with no net cost to taxpayers.
    d. Approach taken in UK must fit with approaches taken in jurisdictions that we fly to from the UK, or that compete with the UK for passengers or fuel uplifts. Also, the approach needs to fit with other activities including R&D and the SAF Clearing House.
    e. Aviation must achieve parity with other CO_2 emitters/ absorbers.
    f. The development of a UK SAF industry and the UK's price support mechanisms associated with sustainable aviation should be world leading and create employment and export opportunities for UK citizens and companies.
2. Expectations
    a. Goal, subject to feasibility, is to have [three] UK plants producing SAF by mid 2020s and up to [14] by 2030 (as per Sustainable Aviation roadmap[1]).
    b. Funding will be needed to initiate FOAK SAF production in the UK and facilitate cost reductions.
    c. If implemented government support via Contracts for Difference (CFD) could provide risk mitigation and thereby support SAF commercialisation.
    d. The CFD mechanism, if appropriate, will complement the DfT's plan to introduce a SAF mandate, currently being consulted upon.
    e. Cost impact of CO2 on users[2] will rise.

[1] https://www.sustainableaviation.co.uk/wp-content/uploads/2020/02/SustainableAviation_CarbonReport_20200203.pdf
[2] All users including aviation

f. Short term cost[3] to taxpayers should be limited. Early funding could be a mix of an amount from public funds equivalent to x% of Air Passenger Duty and Carbon-based incentives[4] on passengers or fuel suppliers.

3. Deliverables
    a. Volumes expected under a CFD mechanism (first few rounds) and expected order-of magnitude costs.
    b. How these costs will be funded (first round and any expected transition).
    c. How CFDs will be awarded (e.g., eligible technologies, eligible feedstocks, potential participants, participation criteria e.g., UK production, planning permission, and selection/allocation criteria)
    d. CFD - RTFO and proposed SAF Mandate interaction.
    e. How strike price and reference price will be set (e.g., administrative price setting rather than auction in first round), giving investors sufficient confidence to develop projects up to the point of readiness for a CFD contract.
4. Plan
    a. Key stakeholders who need to sign up to this proposal include RTFA members (i.e., prospective SAF producers), Sustainable Aviation, DfT, BEIS, Jet Zero, Treasury, Infrastructure Projects Authority and Climate Change Committee. Investor input is necessary to ensure efficacy of the mechanism to support project finance.[5]
    b. The elements of a CFD mechanism for SAF need to be developed by key stakeholders so that they can be set out in a consultation, target late 2021.
    c. DfT secondment will be the most effective way to make a successful consultation happen.

1.3 Methodology

At the outset of the project, it was recognised that knowledge of how a price stability mechanism such as a CfD might apply to SAF production was limited. The first step in the project therefore was to prepare a presentation on how a CfD might apply to SAF and how it compares with other possible support mechanisms. The slides from the presentation "CfD – What you need to know" are included as Appendix A3. This presentation was delivered 4 times and a recording is available via the CfD project sub folder of the Commercialisation Workstream web page.
A questionnaire was then developed by interviewing a subset of industry participants, the sponsors, this questionnaire is included as Appendix A4. The questionnaire uses material from the Low Carbon Hydrogen Business Model consultation issued by BEIS on 17 August 2021. This approach was utilised to determine where support for SAF might use a similar approach to hydrogen and where it might not and why. This approach also reduces the dangers around terminology being misinterpreted. Organisations across the aviation and related industries were then interviewed in order to determine an industry perspective of whether and how a CfD could apply to SAF production.

---

[3] If applicable see 1c.

[4] Mechanisms such as via UK Emissions Trading System funds or via some other method of charging passengers or fuel suppliers

[5] Other stakeholders include existing fossil fuel suppliers and members of the Association for Renewable Energy & Clean Technology, REA.

DfT's role in the project was to work alongside the sponsors in guiding the direction of the project and thereby optimise the nature of the project's deliverables. DfT were not interviewed, and the output of the project does not reflect the opinions of DfT.

The output of the project was presented to the Commercialisation Workstream on 21 September, see slides in Appendix A5. The results were discussed and were confirmed by the meeting as an appropriate representation of the views collected.

The project includes a number of other deliverables than those already discussed including a model of cash flows that reflects how a CfD mechanism could be funded and the payments that would occur, CfD Cash Flow Model see Appendix A6. This project is seen as phase one on the journey to establishing a SAF industry in the UK and the next steps are discussed in 4.7 Phase Two.

1.4 Author

The study was carried out by Nic Rigby of NRG Management Consultancy Ltd. Nic's CV is shown as Appendix A7. Nic was chosen to carry out the work due to his detailed knowledge of the electricity CfD. Nic has no recent experience in or connections with the aviation industry. This independence was felt to be an advantage as it would ensure that Nic would approach the project with an open mind in terms of the needs of government and the aviation industry.

2. The CfD as a concept

2.1 Use of CfDs to support sustainable projects

The first use of a CfD to support sustainable projects was the low carbon electricity CfD implemented in the UK in 2014. This mechanism has been very effective in the UK particularly in terms of its impact on offshore wind with 13 GWs of projects in the 4 rounds (including FiDER[6]) carried out to date and the price falling from £140/MWh to £39.65/MWh (£2012 prices). There have though been issues with the electricity CfD and these are discussed in 3.3 below. The CfD is the third mechanism used in the UK to support large scale renewables which reflects the fact that the UK has devoted significant resources and thought to getting its funding of renewables right. This has been successful as is evidenced by the UK's leading position in offshore wind[7] and industry's support of UK government approach.[8]

The adoption of CfDs by the UK reflects the fact that UK energy markets are relatively unique in terms of the level of competition and preference for free market approaches where possible. The merit of the approach has been recognised elsewhere, however. In 2021 both Holland and Germany are implementing or have announced CfD programmes to support sustainable projects. BEIS's Low Carbon Hydrogen Business Model Consultation describes a variable premium for price support (Examples of variable premiums include the CfD for low carbon electricity generation) as their minded to position.

2.2 Comparison between CfD and alternative approaches

All alternative forms of support, i.e., those that have been used or considered in the UK and other major jurisdictions, that could be utilised to support SAF were evaluated using the principles in the Low Carbon Hydrogen Business Model Consultation. The results are shown in the table below and the principles, which formed part of the questionnaire process see 3.2, are described in more detail in Q1 of the Questionnaire see Appendix A4. A similar analysis was included in the CfD – What you need to know presentation, see Appendix A3. The table setting out the results of that analysis which are consistent with the results shown below are included as Appendix A10.

[66] Final Investment Decision Enabling for Renewables a set of CfDs that were agreed with government as an interim measure between ROCs and the CfD auctions.

[7] https://wfo-global.org/reports/

[8] That support is not without reservations see 3.3 re First of a Kind technology plus also the issue of UK local content. Both of these are recognised in this report and appropriate proposals are included in the Conclusions and Next Steps see 4.2.

Advantages & Disadvantages

	Capital grants	Fixed payments[1]	Certificates	Rating Schemes	Mandates	Tax breaks	RAB	CfD
Promotes market competition	X	X	X	X	√	X	√	√
Investable	√	X	X	X	X	X	√	√
Value for Money	X	X	X	√	√	X	√	√
Reduces support over time	X	X	X	√	√	X	√	√
Compatible	X	X	X	√	√	X	X	√
Technology agnostic	X	√	X	√	X	X	√	√
Size agnostic	X	√	√	√	√	√	X	√
Avoids unnecessary complexity	√	√	√	√	√	√	XX	X

Note 1 Includes production credits

From this table we can conclude that the CfD is the best fit to the principles although it does suffer from the disadvantage of being significantly more complex than all other arrangements, other than the Regulated Asset Base approach.

The key features of a CfD can be considered as:

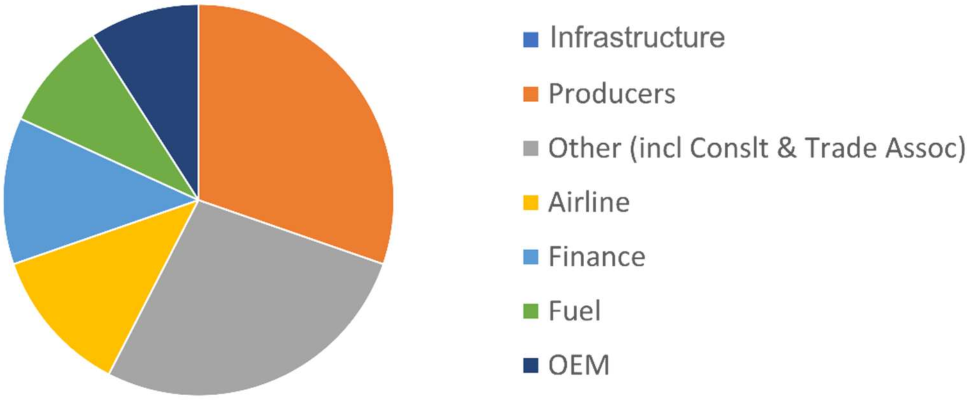
- The CfD holder receives a fixed strike price minus a reference price, where the strike price reflects the total sales income required for the project
- Strike prices can be set by government or bilateral negotiation with developers ('administratively') but they can also be set by competitive auctions between projects – with significant potential for driving down costs
- The reference price reflects the market price that the CfD holder receives by selling the product in a free market
- The CfD is a formal contract, with no regulatory intervention, and is for a contract period that ensures that project finance's investment in capex is recovered within the contract life.

It is this combination of price certainty alongside the potential for driving down costs through an auction mechanism that results in the CfD being the optimum commercially sustainable funding mechanism.

3. Industry perspectives

3.1 Who was interviewed

Thirty-seven organisations from across the aviation industry and beyond were interviewed between 9 August and 21 September 2021. The division of these organisations is shown in the figure below and the names of the organisations are shown in Appendix A8.



All members of the JZ Commercialisation Workstream were asked if they would make themselves available for an interview. In the event 16 organisations who are on the Commercialisation Workstream were not able to make themselves available for an interview. In order to ensure strong representation for some sectors (e.g. potential UK SAF producers) further interviews were carried out with some organisations not on the Commercialisation Workstream.

3.2 Business model principles

In relation to the Business model principles, see 2.2 above, almost all respondents agreed that the principles were appropriate but in addition the following responses should be taken into consideration.

Although it was not a specific question many respondents had a concern that the complexity of a mechanism such as a CfD might delay implementation. Whilst alternative approaches such as grants might be capable of being introduced sooner, they are unlikely to meet the value for money criteria. Hence, they could only be introduced as an interim measure and would be an inefficient use of resources.

Some respondents also challenged whether Technology/ Feedstock agnostic was an applicable principle. Agnostic in this context means that projects compete against each other regardless of the Technology and Feedstock combination utilised. See 3.9 below re Inclusion of different types of projects. Whilst all parties agreed that it was appropriate to ensure that technologies that are considered to be important in terms of potential future value be treated separately, such consideration is in itself subjective. As a result, any scheme that differentiates project technologies is not 100% technology agnostic.

3.3 Is a CfD the solution?

Two of those interviewed were of the view that as CfDs don't work for all technologies they would not support the use of a CfD to enable SAF production. The views of these respondents reflect the reality that the electricity CfD has not been successful for some technologies in particular Advanced Conversion Technology (ACT) and Wave and Tidal. The background to these issues and the underlying reasons are discussed in the box below, but the failings are in the author's view to do with implementation alone and not a reflection of the unsuitability of the CfD.

Failings of the Electricity CfD

The success of the renewable electricity CfD is set out in 2.1 but it should also be recognised that the electricity CfD has not been successful in relation to all technologies. The technologies for which the CfD has not worked include Carbon Capture and Storage (projects to date nil), Wave and Tidal (projects to date nil) and Advanced Conversion Technology, ACT, (11 projects awarded contracts). Of the 11 ACT projects awarded contracts 1 was not signed and 7 have been terminated, 1 of the remaining projects has applied for planning permission for a different technology and 1 is recorded as in construction[9]. Only 1 project, Energy Works Hull, claims to be commissioned but the new owners web site states "In operation. Set for Take-Over Tests during 2021". Energy Works Hull has been the subject of legal disputes[10] which provide details of the problems that have beset this project. ACT projects have generally not been successful in the UK see Eunomia report from 2016[11].

The challenges associated with these technologies and the use of the CfD is not associated with the concept of the CfD. The issues could be considered to be due to 1) lack of flexibility in the electricity CfD milestones and their implementation 2) managing technical risk on First of a Kind plants 3) strong policy focus on offshore wind and as a result the electricity CfD was not focused on getting new technologies started 4) developer optimism meaning that generation dates have been set too early and hence key project dates missed and 5) increasing technical requirements for ACT even though the previous technology was still becoming established.

One of the major issues with applying the CfD to SAF production is that the CfD alone does not enable First of a Kind (FOAK) plant. This needs to be addressed for SAF production where most of the plant will be FOAK or close to it. The challenge is that whilst the CfD addresses market risk a project's technology risk must be at a level that ensures SAF will be produced in sufficient volume to ensure payments. It is this failure to address technical risk that has been a primary cause in the failure of ACT to obtain traction in the UK, see box above. The UK Infrastructure Bank is a new development and is committed to resolving issues associated with technical risk of FOAK plant. UKIB are already engaging with potential FOAK plant developers and this feature alone is a game changer in the funding of FOAK plant. The other development in recent years is that an increasing number of investors are specifically seeking sustainable investments.

If UKIB engages with FOAK plant developers prior to them entering the CfD process and such engagement includes ensuring that technology reviews are carried out, then commercial lenders have confirmed that they will also give early commitments to FOAK plant. This early commitment from the finance community will also impact on engagement between developers and construction contractors. This is another key differentiator between offshore wind and sectors such as ACT. For offshore wind a significant part of the project cost is purchase of turbines and in order to achieve the prices seen in recent rounds of the electricity CfD, developers must know what price they are going to pay for turbines. If SAF developers can demonstrate that they have support of providers of finance, then they can enter into detailed discussions with contractors. Such

[9] https://www.lowcarboncontracts.uk/cfds

[10] Engie Fabricom (UK) Limited v MW High Tech Projects UK Limited [2020] EWHC 1626 (TCC) and Energy Works (Hull) Ltd v MW High Tech Projects UK Ltd & Others [2020] EWHC 2537 (TCC)

[11] https://www.eunomia.co.uk/reports-tools/investment-in-advanced-conversion-technologies-act/

discussions should increase developer's certainty on construction costs and hence their ability to bid competitively.

Several of those interviewed suggested that the UK could learn from the USA's use of production tax credits, PTC. But there are concerns as to whether PTCs are an efficient form of support, see box below.

> **From a Congressional Research Service, part of the US Congress Library, report**
>
> "The PTC has been important to the growth and development of renewable electricity resources, particularly wind. Tax incentives for renewables, however, may not be the most economically efficient way to correct for distortions in energy markets or to deliver federal financial support to the renewable energy sector. Tax subsidies reduce the average cost of electricity, increasing demand for electricity overall, countering energy-efficiency and emissions reduction objectives. Subsidies delivered as non-refundable tax incentives often require renewable energy developers to find "tax-equity" partners to provide equity investments in exchange for tax credits. The use of tax equity reduces the amount of the incentive that flows directly to the renewable energy sector."[12]

Furthermore, a US project developer also stated that although he responded to a more favourable regime in the US by building first in that country, he prefers the UK approach of avoiding tax incentives.

3.4 Funding the business model

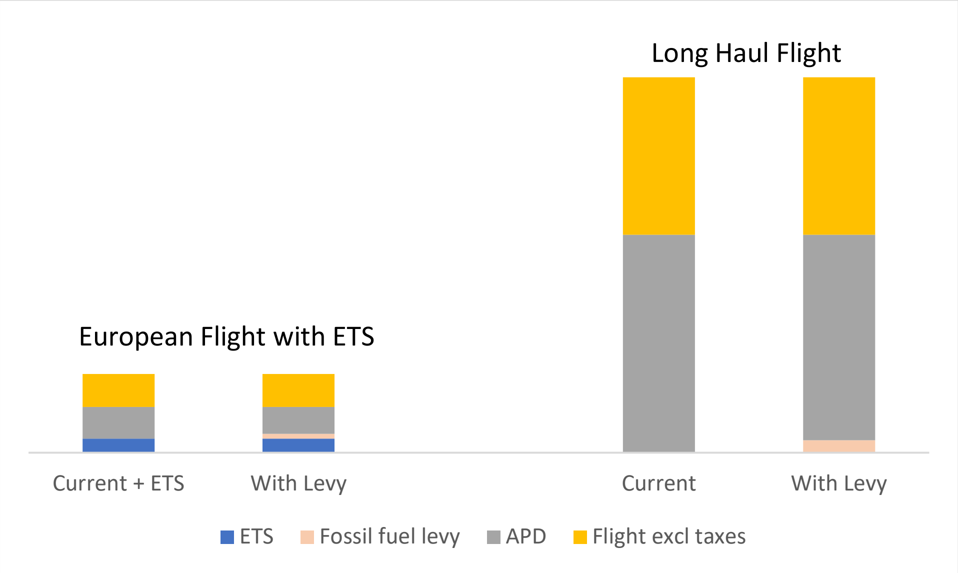
Four alternatives were considered in terms of funding price stabilisation Air Passenger Duty (APD), Emission Trading Scheme (ETS), Fossil fuel levy and taxpayer funding. Only 1 respondent supported taxpayer funding although there was support for some taxpayer funding to the extent that SAF production would be a new industry in the UK and thereby increase UK GDP. There was also support for using any SAF mandate buy-out receipts to support the CfD scheme, but it was recognised that this would not be sufficient to support the CfD on its own unless the mandate were set at such a level as to require a large proportion of buy-out and/or the buy-out price were high. It is also possible that there might not be a mandate buy-out. Increasing the resulting revenue by increasing the percentage obligation or buyout price will have unintended consequences in terms of drawing in SAF imports and potentially starting a bidding war with other countries.

Five respondents supported using APD with the same number supporting ETS whereas 2 supported a new fossil fuel levy. APD has the benefit of being levied on all passengers, but it is not paid by freight. ETS is only incurred by flights within the EU and a few other locations (EU+) but it is a new charge which presumably Treasury have not yet included in their revenue expectations. The fossil fuel levy has the benefit of directly impacting all polluters according to their CO2 impact, including freight. Also, such a levy being used to support price stabilisation is unlikely to be seen as hypothecation. The downside is that it is a new charge on an industry that is about to impacted by ETS and may result in international market distortions.

The solution refunding may be to introduce a new fossil fuel levy, which would fund the CfD, and at the same time modify APD and implement ETS so that the impact on typical ticket prices is no greater than would have been the case due to the introduction of ETS on its own. Tax revenues collected via ETS and APD would be consistent with pre Covid APD levels and international

[12] https://crsreports.congress.gov/product/details?prodcode=R43453

competitiveness would not suffer if non-EU+ flights were not exposed to price rises where APD + fossil fuel levy was kept approximately equal to APD alone pre introducing the change. The figure below shows how ticket prices would be allocated with and without the fossil fuel levy.



This diagram reflects 2030 Carbon prices and cost of the CfD, see CfD Cash Flow Model in Appendix A6. Total tax revenues, APD + ETS, if each of these flights is considered as typical for their category remains consistent with pre Covid APD at £3.5 billion.

In order to understand the financial impact of a SAF CfD a model was created to demonstrate the impact of supporting SAF over 5 allocation rounds between 2025 and 2037. The costs of CfD support can also be compared against the sources of revenue. For more detail on the CfD cash flow model please see Appendix A6.

The table below extracted from the CfD Cash Flow Model shows some of the key figures associated with a CfD and the sources of revenue.

Year		2025	2028	2031	2034	2037		2050
£ value as per year								
How could a SAF CfD be paid for?								
Mandate Buy-out receipts	£m	58	149	213	161	0		0
Carbon permit revenues	£m	493	1442	1910	2434	2898		5199
Air Passenger Duty	£m	3351	3158	2976	2804	2642		2043
Cost of SAF CfD								
CfD price in current contracts	£/tonne	2593	2412	2231	2051	1870		
SAF produced	000 tonne pa	143	357	571	857	1286		2286
Total CfD costs pre mandate premium	£m pa	268	614	883	1145	1405		
CfD cost excl. SAF buyout premium[13]	£m pa	93	235	369	516	663		

[13] Based on assumption that the SAF mandate creates a premium for SAF above Fossil fuel + Carbon credit, see 3.8

3.5 Feedstock and sustainability

It was recognised by all respondents that the sustainability credentials for CfD projects ideally should remain appropriate for the entire contract period. There was also a recognition that new approaches to measuring sustainability should be avoided and the CfD approach should be measurable alongside other internationally recognised approaches. It should also be emphasised that feedstock eligibility needs to consider lifecycle CO_2 emissions and other criteria in terms of social impacts for example on food, water and husbanding of resources etc. Some respondents were critical though of the approach taken by some regulatory bodies (such as the EU under RED II) indicating that in the past they have allocated some feedstock into different categories based on a subjective measure. 17 respondents supported a high initial sustainability standard (70% life cycle saving was proposed) whilst 8 preferred not having a high cut off but discouraging less sustainable feedstock/ technology combinations due to them receiving a lower price per litre of SAF. All respondents were in principle supportive of payments being based on CO_2 saved rather than litres of SAF, but this would need to be done in an administratively straight forward manner. For example, by carrying out regular reviews of a projects CO_2 saving and resetting their payment per litre accordingly. So all regular transactions for each suppliers SAF would be based on litres of fuel but on a regular basis (quarterly or annually) the payment per litre of SAF for that producer would be re-evaluated on the basis of the lifecycle CO_2 emissions associated with the SAF. If the CO_2 emissions, for example due to a change in efficiency, are found to have changed then the CfD payment per litre would change.

The availability of feedstocks was also recognised as an important factor, with respondents stressing the importance of best use. i.e. not diverting feedstocks from other better uses or introducing inefficient usage. For example, see the box below re availability of Used Cooking Oil. Any feedstock that runs the risk of falling outside the definition of waste[14] should not be included in the CfD. Not unrelated to this any feedstock where regional (ie Western European) demand is or could become close to local supply should not be included in the CfD as this is likely to cause market distortions and/or sustainability challenges. Note exclusion from the CfD does not imply that a technology/ feedstock should be excluded from the mandate as the mandate will have more flexibility to change with circumstances than the CfD. Some respondents felt that in the interest of simplicity inclusion in the mandate and the CfD should be consistent. The complexity resulting from different criteria than that used in other measures (including the UK mandate) seems justified though in terms of the additional credibility expectation of the CfD and hence higher criteria being used.

[14] Waste has the meaning given to that term in 2008 Waste Framework Directive 2008/98/EC https://www.legislation.gov.uk/eudr/2008/98/contents

Unintended impact of using Feedstocks that are close to regional capacity
There would appear to be divergent views on the availability of feedstock for example a Prima study found that UK sourced cooking oil is currently less than 50% of the potential.[15] Whilst NGOs such as Transport Environment express an alternative view.

"The main limitation for the HVO capacity is to source raw materials (vegetable oils, grease, tallow and UCO etc.) from sources that are acceptable from a sustainability perspective on the market where they are sold."[16]

"The case of animal fats and Used Cooking Oil (UCO) Ramping up the use of animal fats and UCO could have unintended negative consequences. Animal fats are being used by other industries, such as the chemical industry to make soaps. If the animal fats used to make soap are used to produce biodiesel, a substitution material of similar characteristics will be needed. Cheap vegetable oil such as palm and soy oil are often used as substitutes, creating additional demand and driving deforestation.

UCO sourced domestically with a robust chain of custody can bring high GHG savings compared to fossil fuels. However, there are real concerns about the 'used' status of these oils because UCO may be driving deforestation indirectly. It is thus crucial to scrutinise the origin of UCO more closely and to build a more rigorous chain of custody. Most markets outside of the EU are existing markets for UCO as animal feed and import to the EU will lead to substitution and indirect land use change."[17]

The Department for Business, Energy & Industrial Strategy, BEIS, and others in government have considerable expertise in managing feedstock sustainability see their call for evidence[18] that closed in June 2021 with the outcome to follow. It is recommended that DfT work closely with BEIS in order to agree on 1) an approach to measuring CO_2 savings which fit with scientific and global expectations and 2) other criteria to reduce the danger of feedstock becoming inappropriate later on in the contract 3) the development of a more sophisticated waste hierarchy to reflect the circular economy 4) clear signalling of government support for waste to fuels in future strategy.

3.6 Management of changes in feedstock

Whilst a change in the perceived reputation of a feedstock may occur during the contract period such change needs to be managed in terms of risk allocation. Based on the views of those interviewed the following risks would seem to be appropriate for management by the SAF producer: erroneous reporting by feedstock suppliers and transporters, changes of source issues around availability of feedstock that meet the sustainability criteria. SAF producers are expected to pass through such risks to their suppliers so breaches should be resolvable by the SAF producer with limited interruption to cash flows under the contract. Termination of the CfD due to ongoing breaches can therefore be avoided by the SAF producer utilising appropriate supply contract terms. The exact obligations associated with sustainability need to be structured in accordance with conventional project finance expectations, virtually none of those interviewed felt that unplanned changes in sustainability should be forced onto SAF producers. Risk associated with society changing its expectations re sustainability need to lie with the CfD Counterparty and would fall

[15] https://rtfa.org.uk/wp-content/uploads/2021/04/RTFA-05042021.pdf
[16] https://www.concawe.eu/wp-content/uploads/Sustainable-Biomass-Availability-in-the-EU-Part-I-and-II-final-version.pdf
[17] https://www.transportenvironment.org/discover/making-aviation-fuel-mandates-sustainable/
[18] https://www.gov.uk/government/consultations/role-of-biomass-in-achieving-net-zero-call-for-evidence

within the change in law obligations. There does though need to be an obligation on the SAF producer to engage in a change management process in relation to the issue of sustainability. Such process would grant the SAF producer commercial equivalence associated with any contract changes but would oblige the SAF producer to make contract changes that have been agreed or determined by the dispute resolution process in the contract. Note that independent to the treatment of existing contracts later allocation rounds may include contract updates to reflect changes in society's views on sustainability.

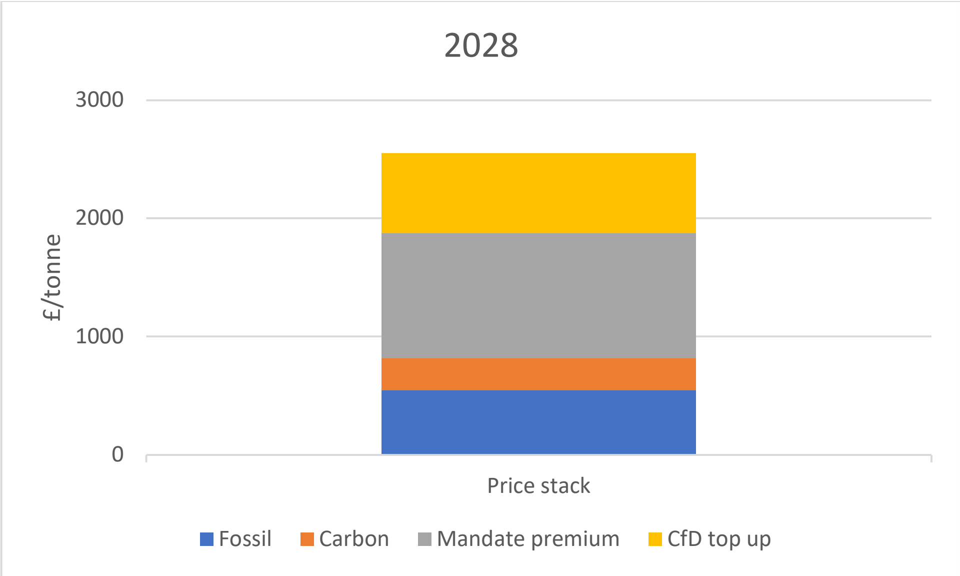
3.7 Indexation of strike price

This question probably gave the most diverse set of views with 6 respondents arguing for the inclusion of feedstock in the strike price indexation and 9 arguing for CPI, 4 respondents argued for simplicity i.e., no indexation. Across all issues there were many requests to take complexity out of the CfD, this issue may be one of those were that approach should prevail. Most of those who argued for feedstock to be included were project developers, but other developers argued that feedstock price risk is best managed within their supply contracts. The case for CPI indexation needs to be demonstrated to government in terms of its inclusion reducing costs to consumers. Whilst the inclusion of feedstock in indexation is supported by most developers it can only be included if there is a market index price for that feedstock. Whilst this may be the case for electricity and should be in the future for hydrogen the establishment of indices for other feedstock is likely to be problematic. As a result, the administrative burden is likely to be greater than the value provided, so it does not seem appropriate to recommend the inclusion of feedstock in the indexation process. This may be an area where the CfD would benefit from simplification.

3.8 Reference price

As set out in 2.2 a key feature of the CfD is the fact that it does not interfere with the market for the underlying product, in this case SAF. For the CfD to work effectively there needs to be an established market reference price. Currently no such price exists for SAF. Until such a reference price is established there are essentially two alternative approaches. One is to determine the actual selling price achieved by the SAF producers with CfDs and the other is to calculate an equivalent price by adding the elements that make up the SAF market price. See figure below which is based on the data in the CfD Cash flow Model, see Appendix A6. It should be pointed out that not all parties agree that there will be a SAF mandate premium. This premium will be driven by supply of versus demand for SAF. In the short-term global demand for SAF driven by societal/ government aspirations is likely to outstrip supply of SAF and thereby create a premium. Whilst market prices may be available for fossil aviation fuel and Carbon permits no data is available on the SAF mandate premium so the latter would have to be calculated by some means such as a factor linked to the Mandate buy-out price[19].

[19] Note it is not certain that there will be a SAF mandate buy-out price.



Some parties felt that the "equivalent price" would be acceptable, given the challenges with the alternatives, but these organisations were typically interviewed early on in the process. During the interview process an approach to assessing actual sale prices as per the box below was identified and those who were asked about this agency approach were supportive of this concept.

Agency Approach to Establishing a SAF Market Price

In time it is likely that a market index price with appropriate volatility will become established for SAF. Alternatively, there are steps that could be taken to encourage the development of such an index. The index price is also more robust if it is based on actual trades rather than being an assessment.

The agency concept would be that an organisation would offer a service whereby it would commit to accepting future deliveries of SAF, but before accepting delivery the organisation would auction the right to accept those deliveries. The parties who originally sold the SAF to the agency would receive the auction price minus a small handling fee.

The government would offer a franchise to a party who has the capability to provide this type of service and in return the CfD would include the option that some say [20%] of the SAF produced by the CfD holder can be called by the agency. If the SAF producer wishes to sell more through the agency they can choose to do so. The price received via the auction would be treated in the CfD as the reference price.

Note the agency should be prepared to operate internationally to ensure maximum liquidity.

It should be noted that the hydrogen business model also faces the same challenge, and the agency approach would also solve the reference price issue for hydrogen.

3.9 Inclusion of different types of projects

The renewable electricity CfD segregates technologies into different "pots"[20] depending on how established they are so Pot 1 Established Technologies includes onshore wind and solar, Pot 2 Less Established includes ACT, floating offshore wind and remote island onshore wind. Offshore wind which was in Pot 2 now has a dedicated pot.

[20] See https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-4-administrative-strike-prices-methodology

Almost all of those interviewed were supportive of the use of pots as is used with the renewable electricity CfD. The need to encourage new entrants was generally considered to be paramount. Many respondents also recognised that the decision as to which technology/feedstock combinations to include in a pot, even for sound reasons such as the need for alternative technology/feedstock combinations that might deliver better value for money in the future, will be subjective and means that the technology agnostic principle is not being applied 100%. Three respondents were sceptical of pots as they were concerned that there might not be adequate competition within pots. One respondent felt that pots should not be used but technologies that need to be encouraged receive grants. This is likely to challenge the value for money principle. Carbon Capture Use or Storage (CCUS) which is not relevant for all technologies was not seen as a facility that should be obligatory from the first round on those projects where it can be used. CCUS ready was seen as a sensible requirement for such projects though and CCUS may trigger projects being included in a higher pot. In later allocation rounds CCUS where relevant could be obligatory.

3.10 Contract duration

Almost all of those spoken to were OK with a 15 year contract duration. Two respondents argued for a longer contract duration, towards 20 years. A few could see a logic for a shorter contract, but it was also recognised that the providers of finance have got used to 15 years in the case of the renewable electricity CfD. Shortening the contract period is also likely to result in higher strike prices. As discussed in 3.6 above the danger of a plant's feedstock no longer being considered sustainable might encourage the use of a slightly shorter CfD. There was some discussion of the contract length being flexible but that may make bid selection overly challenging.

3.11 Increasing plant output

The electricity CfD does not allow increases in the capacity of the plant who have contracts. This constraint is included to ensure that payment increases are capped and thereby better forecasted. For SAF limiting capacity was seen as unduly restrictive, given that SAF plants are process plant they should always be capable of de bottlenecking and or other improvements that can increase the SAF capacity. Some plants may also produce SAF and other materials and this mix needs to be capable of ongoing optimisation. The hydrogen consultation recognises this issue and discusses the possibility of allowing increases in output capacity of 10% to 20%. All respondents agreed that flexibility in capacity was essential. Of those who gave a view on a level 4 argued for 10% and 3 for 20%. Either way it was recognised that any increase would need to be the subject of adequate notice being provided. It was also recognised that the CfD Counterparty should ensure that SAF producers are not over compensated so whilst flexibility above 20% should not be outlawed it is also appropriate that in the case of such increases the strike price should be lowered. This could be done on a gain/ share basis or by linking an adjusted strike price to the price set in auctions at the same time as the SAF producer requests an increase in capacity.

3.12 Allocation of risks

The hydrogen consultation sets out the following proposal re risk allocation. Risks with the producer are: product not meeting the specification in the contract, construction risk, technology risk, decommissioning risk and fuel supply disruption risk. Risks with the CfD counterparty are change in law, policy and regulatory framework. All parties interviewed who had an opinion on risk allocation agreed that this allocation was entirely reasonable.

The hydrogen consultation indicates that network risk ie failure of the CO_2 transportation to accept injections is open for further consideration. This risk should be treated in the same way for SAF as it is for hydrogen and other projects. One view is though that network failures are usually covered by Force Majeure or Business Interruption insurance on which basis the SAF producer can manage them.

3.13 Compatibility with other UK subsidy schemes

The hydrogen consultation suggests the following principles for managing interactions with other schemes:

- maximising the benefits of government intervention, while avoiding the risk of perverse outcomes

• avoiding double subsidisation and/or over-compensation, including by ensuring support is only received once for the same costs

• mitigating the risk of introducing policy complexity and dependencies

• minimising additional administrative complexity

• being adaptable to the potential future introduction of complementary subsidies across the value chain

All those who had an opinion on this issue supported these principles. In addition, several respondents made the point that SAF plants may also be producing other products. This is discussed in 3.11 above. The SAF producer needs to take a view as to how much revenue they expect to receive from the sale of those other products and deduct them from its CfD bid accordingly.

3.14 Allocation of CfDs (auction or negotiation)

There was a view amongst several respondents that bilateral negotiations favour large organisations who can afford the legal and regulatory policy teams to support such activities. As a result, 3 respondents argued for auctions from the outset. The majority of respondents, 12, recognised that auctions would be needed after the first allocation round. This would ensure value for money for consumers whilst enabling the first allocation round to be implemented sooner as some issues could be resolved in the bilateral negotiations rather than additional consultations. Seven respondents thought that FOAK plant and the potential small number of bidders meant that bilateral negotiation would be more appropriate for several rounds until market activity suggests that the process should move to auctions. One respondent argued for an administrative price being used. This is unlikely to deliver value for money to consumers though.

It is suggested that DfT use bilateral negotiations in the first allocation round and review interest in that round before deciding whether to move to auctions in the second or a later round.

3.15 Obligation to build/ penalties

Eleven respondents supported bid bonds being required from the date a producer is allocated a CfD through to the point when a project is committed, these respondents did not give a view as to the size of the bonds. A further 6 respondents supported bid bonds of the order of £100ks. The existence of non-serious bidders for the electricity CfD was seen as an issue by all respondents but there were also concerns that small players might find the cost of a bid bond overly onerous. Some respondents argued for the scaling of bid bonds by project size, this would be a reasonable approach provided the minimum size of the bid bond, probably £100k, is still large enough to deter non serious bids. Three respondents supported bid bonds for auctions but felt that they were not necessary for applicants participating in bilateral negotiations, as non-serious bidders could be identified during the assessment process or subsequent negotiations. Two respondents were of the view that bid bonds should not be used at all.

3.16 Underwriting the CfD contract

All of those who expressed a view on the issue of credit support agreed that the best approach was to replicate that used by Low Carbon Contracts Company, LCCC. If LCCC should find itself in a situation where it does not have enough cash to make all payments under the electricity CfDs then it (actually its agent Elexon) has been given the regulatory right to collect sufficient funds to make all necessary payments. These payments may be made late in which case the CfD sets out how interest is paid to CfD holders. This approach has been accepted by lenders as sufficient in terms of LCCC's credit worthiness. Whilst the aviation fuel market is not used to the same level of regulation as electricity there would not appear to be any barriers to the LCCC approach being carried across to the SAF CfD market.

Concerns were expressed by at least one respondent about the cost of establishing a CfD counterparty which is owned by government. On the other hand, the LCCC model has been shown to work. DfT will need to determine the governance of the CfD and whether LCCC is considered as a potential counterparty or whether LCCC is used as a model to create a similar body but owned by DfT.

3.17 International interactions

It is expected that the introduction of a SAF price stabilisation mechanism is likely to be subject to the mechanism that replaces the EU state aid rules. Whilst the exact terms of any such regulations are unknown it is to be expected that the UK will commit to not distorting the local markets of those countries that we trade with. The CfD can demonstrate that it is not an inappropriate subsidy provided the SAF volumes produced under the CfD are within the UK market demand for SAF.

Levies such as ETS or taxes on airline passengers in countries that are committed to reducing CO_2 emissions are likely to go through major changes in the next few years. The UK has an opportunity to lead these changes if it adopts an approach that is logical and can be signed up to by other countries.

Almost all respondents felt that the CfD alone should not create difficulties in relation to the international flight markets. The issue of additional costs imposed on those flying from the UK compared with alternatives both in terms of costs and market size should be monitored. It is recommended that DfT and industry work together to 1) develop mechanisms in the UK that others may wish to replicate 2) work with other countries to maintain consistency and discourage environmentally sub-optimal decisions re flying 3) monitor market developments to further improve 1 and 2. Investing in optimising the CfD and mandate will help develop the UK SAF industry but also promote UK expertise in commercial approaches to managing climate change.

One symptom of market distortions is "tankering", i.e. aircraft uploading fuel in country A and carrying it to country B to deliberately avoid loading fuel in Country B even though carrying the fuel results in higher fuel usage. Whilst tankering results in inefficient fuel usage there are circumstances, including air traffic management, where airlines have no choice but to manage fuel by tankering. Most respondents were of the view that it would be difficult to take action to stop tankering but it was agreed that planes fuel tank contents and UK fuel loading should be monitored. This would provide useful data and help make the case for changes that are beyond the control of the airlines, such as air traffic management. This data might also influence passengers who are concerned about CO_2 emissions. Monitoring would enable any issues to be identified and decisions made as to whether further action is necessary, including managing aIr traffic control issues and thereby reducing fuel wastage due to tankering .

Whilst CORSIA will at some point in the future provide an opportunity to create significant (ie greater than CORSIA's current aspirations) global incentives for low CO_2 emission flying such a change will be challenging to implement and as a result is unlikely to offer an immediate opportunity. It may be possible though that the long-term climate target currently being developed by ICAO presents an opportunity for global SAF ambition.

Some of those interviewed wanted to retain SAF produced within the CfD in the UK, whilst a larger number of respondents felt that international trade in SAF is critical to its development. Constraining where product is used undermines one of the CfDs benefits in that it does not distort the SAF market. So this measure would not be appropriate although the UK market for SAF is likely to absorb all the SAF that is produced in the UK and exports of SAF will be further discouraged by the cost of transporting it to other countries.

4. Conclusions and Next Steps

As is apparent from 3. Industry Perspectives there were four areas where industry views were divided. These areas are: Is a CfD the solution?, Funding, Feedstock and Indexation and are discussed in detail below. The first of these "Is a CfD the solution?" is only important because the decision needs to be made quickly. The second funding is the most challenging in terms of establishing a solution that is accepted by all those affected. The remaining issues Feedstock and Indexation should not be challenging to resolve. On other areas industry views were generally consistent so these are discussed in less detail.

4.1 Is a CfD the solution?

Whilst the principles used to determine what type of price stabilisation/ support is used were generally agreed there are two issues that need to be addressed by DfT. Firstly DfT need to confirm that the short and long term solution is a CfD Industry (via Jet Zero Council) should work with DfT should support this process by drafting alternative term sheet (or sheets) if necessary. Note that given the commercial sustainability challenges associated with alternatives to a CfD such alternatives are likely to be interim measures with a CfD as a medium-term solution. The resource implications of an interim measure will need to be taken into consideration.

The second measure will be ongoing in relation to CfD development and will also apply to BEIS's work on supporting hydrogen projects. The genuine concerns of "CfD sceptics" should be taken into consideration and recognised in the CfD development task. This will include ongoing discussions with UKIB in terms of the role they are able to take in relation to facilitating the development of FOAK plant in the UK, as well as how UKIB will interact with commercial providers of finance.

4.2 Funding

Funding should be seen as a separate issue from the decision re the form of price stabilisation/ support. The solution to the funding issue would appear to involve some mix of Air Passenger Duty, ETS permit auctions and a fossil fuel levy. The concept of a fossil fuel levy was only raised part way through the interview process so was not fully explored in this phase of the project, respondents did though express concerns in relation to any new taxes on aviation. Exactly what form that mix should take depends on how the needs of industry (i.e. avoiding sudden and material cost impacts on consumers as well as managing any new costs that don't fall equally on all consumers) can be meet alongside the needs of government in terms of politically acceptable and affordable solutions. Industry (via Jet Zero Council) to support this process by supporting DfT/ Treasury modelling of alternatives.

4.3 Feedstock

The exact details of sustainability eligibility criteria should be discussed by experts both within and outside of government. The methodology for measuring sustainability though should be consistent with other mechanisms used in the UK and in other jurisdictions particularly the EU. The UK should set high aspirations based on scientific principles which are enshrined in law such as the Carbon Budget.[21] One of these principles is likely to be to exclude feedstocks that are close to regional capacity with the potential to trigger unintended consequences. The risk allocation in relation to sustainability should be clearly set out in the contract, see 3.6. Setting a high initial standard, at around 70% life cycle CO_2 saving, for sustainability would appear appropriate but this standard should be set not by a sharp cut off by linking payments to tonnes CO_2e saved and causing such

[21] https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035

payments to fall away quickly below the high initial sustainability expectation. The inclusion of time or event driven changes to sustainability in each CfD contract should also be considered.

4.4 Contract Changes

In order to avoid the risk of undermining the investibility of the CfD the sustainability requirements including any developments during contract life will need to be practical in terms of achievement by SAF producers. The potential for changes in perception of sustainability may be a reason to shorten the contract period, if only for a few years as the overriding issue should be recovery of investment within the contract period. The downside of a shorter contract though is the higher cost to users of the resulting increase in strike prices. Contract changes need to be allowed for or even encouraged in relation to plant capacity see 3.11, sustainability as well as change in law. Whilst different parties may initiate the change process the resolution process should be via engagement and ultimately expert evaluation to achieve commercial equivalence for all parties.

4.5 Indexation

Whilst various forms of indexation would provide commercial balance implementation of some of the more detailed approaches (e.g. feedstock indexation) would be challenging to implement. This is an area where simplification is probably the overriding principle so no project specific indexation should be included. On the basis of risk management principles government has more ability than industry to manage inflation so this risk should lie with the CfD counterparty.

4.6 Answers

On the following topics industry generally had a consensus view so if DfT support the proposed solutions they could be presented as a “minded to” solution and industry’s general support should be expected.

Issue	Answer – General consensus (see sections for further details)
Reference price	Achieved sales price & agency that auctions (3.8)
Contract allocation	Negotiation at start then auction (3.14)
Technology/ Feedstock pots	Approach as for electricity (3.9)
Change in Sustainability requirements during contract	Change can be requested but must be commercially equivalent (3.6)
Contract duration	15 years but see 4.4 re a slight reduction (3.10)
Increase in production capacity	Limited flexibility in contract but then gain/ share (3.11)
Risk allocation	As per hydrogen principles (3.12)
Penalties for early contract failure	Bid bonds of £100ks (3.15)
Underwriting of contract by CfD Counterparty	Regulatory arrangement as per electricity (3.16)

4.7 Phase Two

Industry expects, see Jet Zero programme[22], that the call for contract bidding would go out in late 2022. Construction would then start in 2023 and first UK SAF production would occur in 2025. This timetable is already looking particularly challenging and in order to achieve SAF production by the mid 2020s decisions as to what form of support, see 4.1, would need to be made soon and a consultation on that approach initiated as soon as possible thereafter.

Discussions to date have concluded that a secondment by Nic Rigby would be a highly effective next step. As this secondment would be funded by industry in order to see the consultation process advanced there needs to be an understanding in relation to the consultation by DfT and industry. The decision to send out a consultation is of course DfT's but before committing to spend industry needs to have an expectation of the deliverables.

A secondment would solve a number of challenges including DfT current challenges around short term resourcing, and their access to CfD expertise. Secondment could also lead to coaching and development of DfT's SAF price stabilisation team. So as well as knowledge gained in phase 1 wider knowledge would also be transferred to existing and incumbent DfT staff. Industry's expectation is that the secondment would be full time for 3 months.

[22] See appendix A9

Appendices

A1, Glossary

Term	Definition
APD	Air Passenger Duty
Buy-out price	The SAF mandate may include a mechanism whereby those who are obliged to meet the mandate can opt to pay a Buy-out price if no SAF is available at a reasonable price.
CfD	Contract for Difference
CCUS	Carbon Capture, Utilisation and Storage
CCS	Carbon Capture and Storage
ETS	Emission Trading Scheme
EU+	EU countries a small number of other partners that have agreed to apply ETS permit auctions to flights leaving those countries
excl.	excluding
FiDER	Final Investment Decision (FID) Enabling for Renewables - Investment Contracts
FOAK	First of a Kind
GHG	Green House Gas
GDP	Gross Domestic Product
HVO	Hydrotreated Vegetable Oil
LCCC	Low Carbon Contracts Company
MSW	Municipal Solid Waste
Pot	The electricity CfD categorises into pots different technologies according to the level of funding they require and projects in each of these pots compete against all the projects/ technologies in the same pot.
PTC	Production Tax Credits
RAB	Regulated Asset Base
REA	Association for Renewable Energy and Clean Technology
RED	Renewable Energy Directive
ROC	Renewable Obligation Certificate
RTFA	Renewable Transport Fuel Association
RTFO	Renewable Transport Fuel Obligation
SAF	Sustainable Aviation Fuel

A2, Terms of Reference Q and A

Question and Answer

The discussion below captures comments made within the sub-group meeting of 20 August 2021 which did not warrant a change to the TOR, but support the ongoing development of this work.

Q Is there any scope within this work to look at alternative methods to CfDs?
A Yes, for understanding how other schemes may be more effective than CfDs. However, the report will not fully explore mechanisms such as grants, feed in tariffs or tax incentives and what these would look like.

Q CfDs have not been effective for complex projects to date. SAF is expected to be even more complex than previous projects, how will this be managed?
A This work will explore why CfDs have failed in the past for complex projects. There are several reasons suggested for it including capability of the technology, risk allocations and commitment levels.

Q SAF has several pathways, feedstocks, and chemistries. It is suggested that a number will be required to support decarbonisation of the aviation sector. How will a CfD cope with technologies at varied levels of maturity and different cost points, without letting the most developed technology 'win'?
A There will be a requirement for pots[23]. Technologies within the same pot would compete for a CfD and there may be different terms for different pots. This is an area that the SAF CfD will need to develop on.

Q DfT have asked for evidence on the effectiveness of CfDs, where is this within the scope beyond 'principal advantages' and is there any consideration of looking at the Dutch SDE ++ Programme.
A Schemes do need to be part of the evidence base, but they are limited in number. Other environments will be considered, but other than the electricity CfD there is limited established information.

Q How is the scope and fuel supply going to be managed in this changing world with a lot of low-cost budget airlines wanting to stay as cheap as possible.
A That issue impacts all the current changes considered including the RTFO and the Mandate and there will be consideration of how other schemes have managed with these practical issues previously.

Q The goal of having 3 operational UK plants by mid 2020s is conventional thinking, focusing on a number of plants rather than production targets. We should not limit ambition by focusing on a number.
A Due to the CfD requiring steps, this can be considered as units. However, the key deliverable is volume. As part of this work a model will be developed setting out the number of plants and the quantity, at this stage volume will be addressed.

Q The scope must outline the deliverables, e.g., GHG saving or volume. What is the quantity targeted?
A This will be a question posed within the questionnaire.

[23] All bidders in a pot compete against each other, so each pot which will include a mix of projects and potentially technologies will set its own price in an auction.

Q We should be careful saying fuel produced in the UK should be consumed in the UK. Export finance is already being made available and this is potentially a route to obtaining finance for UK SAF plant development.
A The study will focus on UK production rather than utilisation but to simplify modelling of the impact of UK SAF production it may be appropriate to assume UK production is used in the UK. All aspects of a UK SAF industry (including Intellectual Property associated with price stabilisation) should though be seen as an export opportunity.

Q Should a methodology section be included within this document?
A This project will principally include interviews from industry stakeholders. The modelling will be done on publicly available data and issues associated with cost will come from interviews with producers

A3, CfD – What you need to know presentation

CfD - What you need to know

Nic Rigby

NRG Management Consultancy
+44 (0) 7989494432
nic@consult-nrg.co.uk

V2.1 16 August 2021

1

Disclaimer

- The views expressed in this presentation are my own.
- I would like to thank those who have provided support on the content
- ...but any errors are down to me
- This presentation does not represent the views of those who are sponsoring the SAF CfD project or those participating in the steering group for that project.

2

Agenda

- What is a CfD (Contract for Difference)?
- When a CfD works
- Alternative incentives
- CfD content
- Environmental Sustainability - Optional
- Back up - Optional

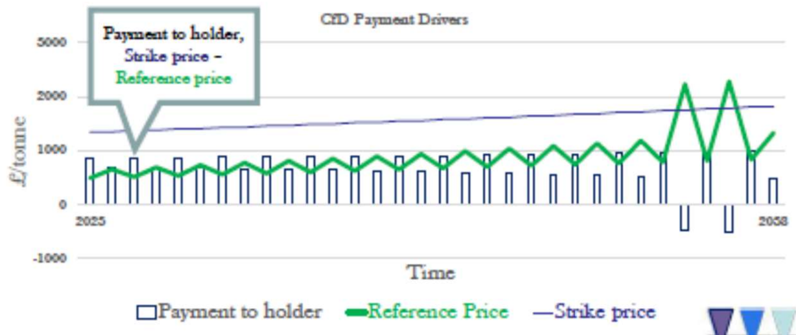
3

Acronyms

- AR = Allocation Round (electricity CfD)
- CCC = Climate Change Committee
- CCS = Carbon Capture and Storage
- CCUS = Carbon Capture, Utilisation and Storage
- CfD = Contract for Difference
- CRI = Commercial Readiness Index
- ETS = Emission Trading Scheme
- MSW = Municipal Solid Waste
- RAB = Regulated Asset Base
- ROC = Renewable Obligation Certificate (electricity)
- RTFO = Renewable Transport Fuel Obligation
- SAF = Sustainable Aviation Fuel
- SAFp = Sustainable Aviation Fuel producer
- TCW = Target Commissioning Window (electricity CfD)
- TRL = Technology Readiness Level

4

Why a CfD gives price stability



5

What is a CfD (Contract for Difference)?

- ∇ Contract agreed between two parties (CfD Counterparty and SAF producer) which requires Counterparty to pay SAFp, Strike price – Reference price. If Reference price is > Strike price SAFp makes the payment.
- ∇ Provides price stability to the SAFp
- ∇ Reference price includes cost of carbon so no double dipping by SAFp
  - ∇ Reference price is "Clean" so Carbon cost is accounted for

6

Agenda

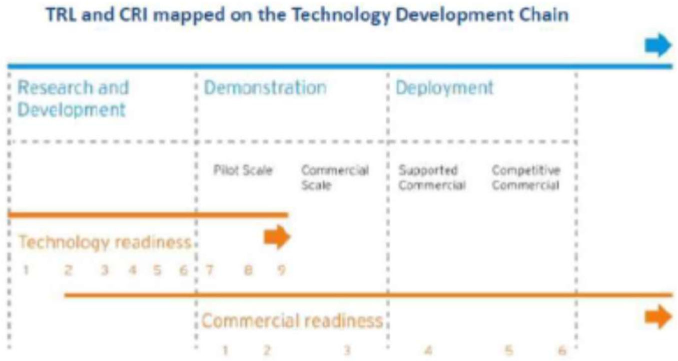
- ∇ What is a CfD (Contract for Difference)?
- ∇ When a CfD works
- ∇ Alternative incentives
- ∇ CfD content
- ∇ Environmental Sustainability - Optional
- ∇ Back up - Optional

7

When a CfD works

- ∇ Technology Readiness of 7 to 9 and commercially viable
- ∇ Reduced cost of financing comes from long term certainty of
  - ∇ Price and
  - ∇ Obligations
- ∇ Draws in multiple suppliers for market growth
- ∇ Capital intensive implementation

8



Source: ARENA (2014), *Commercial Readiness Index for Renewable Energy Sectors.*

Taken from paper by IEA 15 May 2017

9

Agenda

- ∇ What is a CfD (Contract for Difference)?
- ∇ When a CfD works
- ∇ Alternative incentives
- ∇ CfD content
- ∇ Environmental Sustainability – Optional
- ∇ Back up - Optional

10

Alternative incentives

Support mechanism	How works	UK Electricity industry
Capital grants	Contribution towards cost of building is provided	12 Round 1 offshore wind projects paid approx. £10m each
Fixed payments	Supplier is offered a fixed price per unit of output	Feed in tariff as for domestic PV
Certificates	Suppliers receive £ for every sustainable unit produced.	ROCs
Rating schemes/ Green market differentation	Government forces suppliers to declare sustainability	Rating of appliances
Mandates/ Permit	Government stipulates that a % of market must be sustainable or pay a buy out	UK ETS
Tax breaks	Government incentivises by reducing taxes	R&D funding
Regulated Asset Base	Users of the plant pay support to the producer determined by the cost of build and a low cost of borrowing.	Nuclear CfD

11

Advantages & Disadvantages

	Capital grants	Fixed payments	Certificates	Rating Schemes	Mandates	Tax breaks	RAB	CfD
Rewards delivery	X	√	√	X	√	X	√	√
Who funds	Tax payer	Flexible	Polluter	na	Polluter	Tax payer X	Polluter	Flexible
Stops Double dipping	X	X	X	√	√	X	√	√
Cost control	X_1	X	X	X	X	X	X	√
Risk allocation	X	X	X	X	X	X	X	√
Market expansion	X	X	X	X	√	X	√	√
Consistent	X	X	√	?	√	X	?	√
Simple	√	√	√	√	√	√	XX	X

1. Can partly manage by auctioning contracts but has other challenges

12

Agenda

- What is a CfD (Contract for Difference)?
- When a CfD works
- Alternative incentives
- CfD content
- Environmental Sustainability – Optional
- Back up - Optional

17

Sustainability – Key Considerations

- High confidence in sustainability throughout CfD contract life, K1
  - Certification (including provider of certificate), K2
  - Sustainable includes equivalence, additionality and permanence, K3
- Feedstock only sourced from countries meeting current COP Agreement, K4
- Sustainable Feedstock goes to where it has most Carbon impact, K5
  - Expected to change over time, K6
- Land use interaction and social obligations, K7
  - Challenging to evaluate and likely to change over time K8

18

Sustainability – CfD Implications

- To ensure Sustainability principles are met, C1
  - Feedstock obligations may change during the contract, C2
  - This feature is included in electricity CfD, C3
- High standards for Sustainability in CfD, C4
- UK should encourage unification of sustainability standards, C5
  - Some issues will be geographically and Carbon usage dependent, C6
- Imported feedstock from locations where permanence cannot be relied upon should be excluded, C7
- In the future CCUS in SAF production may need to be considered, C8

19

Sustainability - Parameters

- Full life cycle usage impact of feedstock, P1
  - Counterfactual is next best usage, P2
  - Full life includes land effect (direct and indirect), processing, transport, P3
  - CCC proposed 8gCO_2e/MJ as Electricity CfD requirement, P4
- Broad sustainability issues, P5
  - Social issues, forestry/ waste management, transportation, local environment, P6
  - Interaction with other resources, habitat, direct and indirect land usage, water, food production, ecosystem, wildlife, soil quality, P7
- Process robust and includes random audits, penalties for non compliance, P8
- Re-evaluation even beyond CfD lifetime, P9
- Waste sources must have been minimised and recycling optimised, P10

20

Feedstock - Exercise

• Food crops or those grown on good land	In/ Out
• Energy crops from marginal land	In/ Out
• Forestry residue	In/ Out
• Agricultural residue	In/ Out
• Biogenic waste with other economic uses (incl sawmill residues)	In/ Out
• Recycled Carbon Fuels (also what sub sets apply)	In/ Out
• E fuels produced using nuclear energy	In/ Out
• Material grown on high carbon stock land	In/ Out
• Renewable Fuel of non biological origin	In/ Out
• Hydrotreated Esters and Fatty Acids (HEFA)	In/ Out

Give your view as to whether expect each feed stock is likely to be included or not and why not. See codes in previous 3 slides. Note this list does not reflect all feedstocks, also sub sets may be both In and Out.

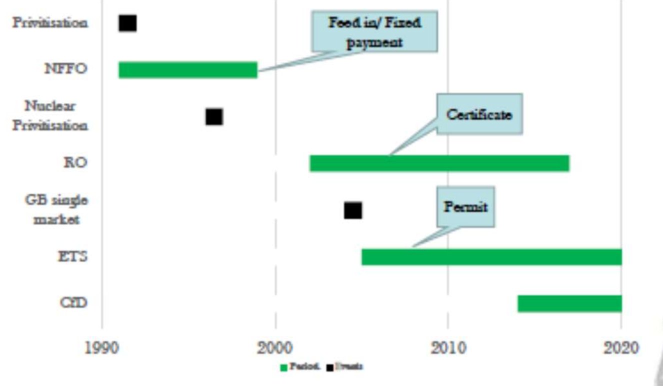
21

Agenda

- ∇ What is a CfD (Contract for Difference)?
- ∇ When a CfD works
- ∇ Alternative incentives
- ∇ CfD content
- ∇ Environmental Sustainability – Optional
- ∇ Back up - Optional

22

History of Low Carbon GB Electricity



23

Typical Electricity CfD Time line

Event	Announcement of AR	Announcement - Bidding	Bids evaluated & winners announced	Contract signing & Condition Precedent process
Time allowed	AR every 2 years	Up to 11 months	1 month	1 month
Notes	Contract form and process 99% set at time of announcement	Budgets finalised, Bidders register and are qualified. In early AR qualification delayed the process.		

Commitment milestone	Build period	Target Commissioning Window	Contract period	Long Stop Date
18 months	Set in Bid	12 months	15 years from end of TCW	12 months from TCW
CfD holder must spend 10% of est capex or Financial Close		Contract can start in this window without penalty		If plant not operational CfD can be terminated.

24

SAF - CfD Other specific factors

- Obligation to commit to build, Bond
- Start of payments/ Commissioning
- Access to other government subsidies
- SAFp receives £ per unit produced (at required standard)
- Stapling of CfD and the production plant
- Increase in Strike price

25

CfD Other clauses

- Capacity of facility
- Measurement of output
- Billing and settlement
- Payment issues
- Warranties (Information etc)
- State aid
- Sustainability monitoring
- Production taxes

26

Boiler plate

- Conditions precedent (Know your counterparty etc)
- Change in law
- Confidentiality
- Force majeure
- Law and jurisdiction
- Notices
- Variations
- Dispute resolution

27

A4, Questionnaire

Note terminology should be consistent with the Hydrogen Business Model Consultation[24] . Relevant sections in that consultation are shown in { }. To avoid duplication the Hydrogen consultation has been used as a framework. Where SAF requires a different approach this is (or should be covered) by the questionnaire.

1. Business Model (CfD or other mechanism) {Table 3}
   Do you agree that for SAF "Promotes market development" would be well supported by a SAF mandate?
   Do you agree that all the other design principles apply to SAF price support?
   If not why not?

Principle	Description
Promotes market development	Model should incentivise producers to seek and develop sources of demand for hydrogen and promote its use
Promotes market competition	Model should not create barriers to market entry, enable abuse of market power, or provide an enduring competitive advantage to first movers compared to later market entrants
Investable	Model should provide sufficient predictability over revenues and returns to investors and mitigate risks which investors are not best able to bear
Value for money	Model should be effective in achieving its intended purpose at the lowest possible cost to government and prevent excessive returns to developers
Reduces support over time	Model should allow for revenue support to producers to reduce over time (within and between contracts) by being responsive to evolving market conditions and encouraging learning, innovation, and cost reductions over time
Suitable for future pipeline	Model should be fit for purpose for FOAK projects as well as nth of a kind projects with minor or reasonable adjustments
Compatible	Model should be compatible with other policies across the value chain and should not result in double subsidisation of the same units
Technology agnostic	Model should be applicable to a range of production technologies (provided they meet the low carbon hydrogen standard and do not create an enduring competitive advantage for one technology over another)
Size agnostic	Model should be applicable to a range of project sizes and should not incentivise inefficient sizing of production plants
Avoids unnecessary complexity	Model should avoid unnecessary complexity in its design, implementation and administration, and be transparent for producers to comply with

2. Price support {4.1}
   Government is minded to reduce market price risk for Hydrogen projects with a variable premium (CfD) option. Do you believe that this approach is also appropriate for SAF? If not which approach do you favour and why. In relation to First of A Kind technologies do you believe that such technologies should be supported by government infrastructure funding support (for example a UK Infrastructure Bank) or other means.
3. Reference price {4.2}
   Government preference for Hydrogen is that a market benchmark price is best once it is representative. Do you agree with this approach for SAF? Prior to establishment of a market benchmark for SAF what should be used as a reference price
   a. Fossil fuel + Carbon market benchmarks

[24] https://www.gov.uk/government/consultations/design-of-a-business-model-for-low-carbon-hydrogen

    b. Achieved sales price (as proposed for Hydrogen but with a floor)
    c. Other arrangements

Do you agree that the logic for developing a market for SAF is different from Hydrogen, eg there is only one use for SAF?

4. Indexation of Strike Price {4.3}
   For SAF the key choices would seem to be inflation (CPI), feedstock or some combination thereof. Which approach do you think is appropriate including why that risk should be passed through to those who fly? Should different indexation approaches be applied for different technologies?
5. Feedstock/ Sustainability
   For a long term contract do you support a high initial sustainability target?
   Sustainability at same level as current mandate proposal or higher?
   EU RED as start (Annex IX Part A)
   28 gCO_2e/MJ (70% lifecycle saving) as minimum
   Should any particular feedstocks be included/ excluded and why?
6. Management of changes in feedstock/ sustainability
    a. Should changes to the contract be allowed?
    b. How should these changes be controlled?
7. Applicability of the business model across different types of project
   Should CfD payments be linked to CO_2 saving (as per mandate proposal)?
   Should there be different pots for different technologies?
8. Contract duration {7.1}
   15 years? Should shorter contracts be used to manage changes in some feedstock/ sustainability expectations
9. Scaling of output {7.2}
   For hydrogen the “minded” solution is to allow some flexibility in terms of a 10% to 20% increase in capacity at a lower strike price. Above this limited increase the strike price would be set by a competitive process.

10. Allocation of other risks {7.3}

Table 4: Risks relating to hydrogen production projects

Risk	Description	Allocation
Change in law, policy or regulatory framework risk	Risk that any change in law, policy or regulation impacts hydrogen production or hydrogen consumption. This could be where a change impacts on the cost of producing and/or using hydrogen, the uptake of hydrogen, or on the feasibility of delivering the necessary infrastructure for carbon capture and/or future hydrogen infrastructure development	The business model contract would set out appropriate provisions to protect the hydrogen producer from certain unforeseeable and material changes
Qualifying hydrogen risk	Risk that hydrogen produced does not meet the low carbon hydrogen standards and therefore may not qualify for support payments. This could happen in a number of situations. One example would be where the CO2 T&S network is unavailable due to a temporary outage and CCUS-enabled producers are unable to inject CO2 into the network	We are considering the most appropriate way of managing this risk across a number of different scenarios However, in principle, where the producer is at fault for producing hydrogen that does not meet the standard, we are minded to not provide support On the other hand, where the producer is not at fault, we are considering the most appropriate way of managing the risk with further work on this to be undertaken in 2021
Construction risk	The risk of construction overruns and, as a result, an increase in capital costs	The developer of the hydrogen production plant is best placed to manage construction risk through effective risk and financial management, including sufficient allocation of contingency within their budget Where hydrogen producers may apply and be successful for capex support

Do you agree that the equivalent risk to that highlighted in yellow does not exist in relation to SAF? Should changes to the SAF specification be handled through commercial negotiations.

Otherwise do you agree that the allocation risk profile for SAF should be similar to that for Hydrogen? See also table below and question 2 re FOAK.

Risk	Description	Allocation
		through the NZHF, government may cover a fixed percentage of a project's initial cost estimate, including contingency costs, where this represents value for money
Technology risk	Risk that technology related to low carbon hydrogen production fails or does not behave predictably	The hydrogen producer is responsible for procuring technology with a high level of confidence, and ensuring there are contingency plans if it were to fail
Decommissio-ning risk	Risk that decommissioning costs are higher or lower than originally forecasted, or where the hydrogen producer is unable to carry out the decommissioning process	The hydrogen producer is responsible for decommissioning the hydrogen plant in line with the relevant industry standards
Input fuel supply disruption risk	Risk that an energy network supply mismatch, unplanned outage or inconsistent input fuel supply means that hydrogen producers are unable to fulfil offtaker contracts	The hydrogen producer is responsible for managing this risk to ensure they have a supply of input fuel to produce low carbon hydrogen

11. Compatibility with existing subsidy regimes {7.4}
    For Hydrogen the government propose the following principle be applied.

We will consider the following principles to ensure the business model interacts effectively and is compatible with other sources of support across the value chain:
• maximising the benefits of government intervention, while avoiding the risk of perverse outcomes

• avoiding double subsidisation and/or over-compensation, including by ensuring support is only received once for the same costs

• mitigating the risk of introducing policy complexity and dependencies

• minimising additional administrative complexity

• being adaptable to the potential future introduction of complementary subsidies across the value chain

Do you agree that the same principles should apply to a SAF business model (CfD).

12. Allocation {8.0}
    What combination of application/ bilateral negotiations and auctions would you consider to be appropriate?
13. Funding the Business Model {9.0}
    See SAF cash flows model and Chart of emissions and costs. Do you agree that the SAF CfD should be funded by ETS permits auctioned and used by the aviation industry or APD? Do you agree that using the SAF mandate as a revenue source is inappropriate? Alternatively how do you think the SAF CfD should be funded?

The model uses the EU proposal re aviation ETS permit auctions (25% in 2024 increasing to 100% in 2027) do you consider this appropriate?
The model assumes that the first CfD round would pay $3500/tonne of fuel with annual cost reductions of 4% (£ of the day) thereafter. Do you consider these figures are reasonable?

14. Obligation to build/ penalties
    Should be bidders be obliged to place bid bonds? At what value e.g. several £100ks or % of project size?
15. Underwriting the contract
    Do you agree that the Low Carbon Contracts Company model, with modifications to fit the aviation fuel market, should be used to establish a CfD Counterparty.
    Should a similar system be implemented as for electricity where a Regulator allows a levy to be collected by the CfD counterparty to ensure CfD payments are met. Note late payments with interest may be necessary.
16. International interactions
    See Chart of emissions and costs. What do you consider are the major issues around international interactions?

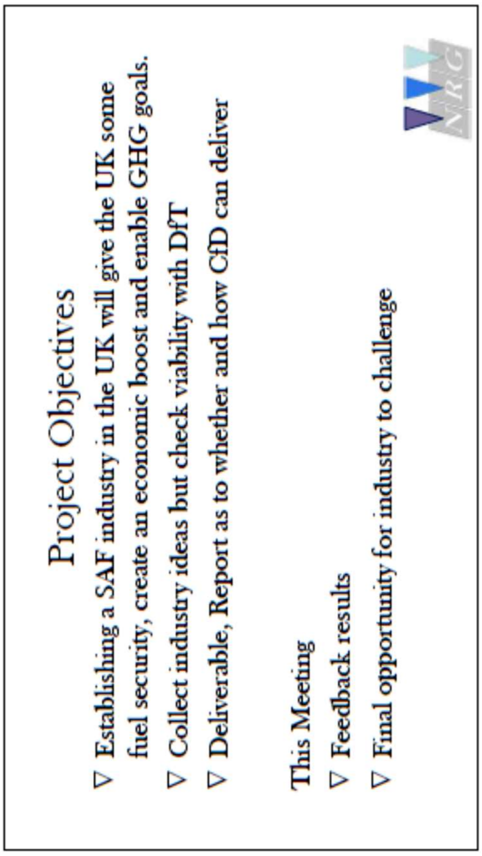
17. Are there any other issues that you think need to be considered now in relation to SAF price stabilisation?

Nic Rigby

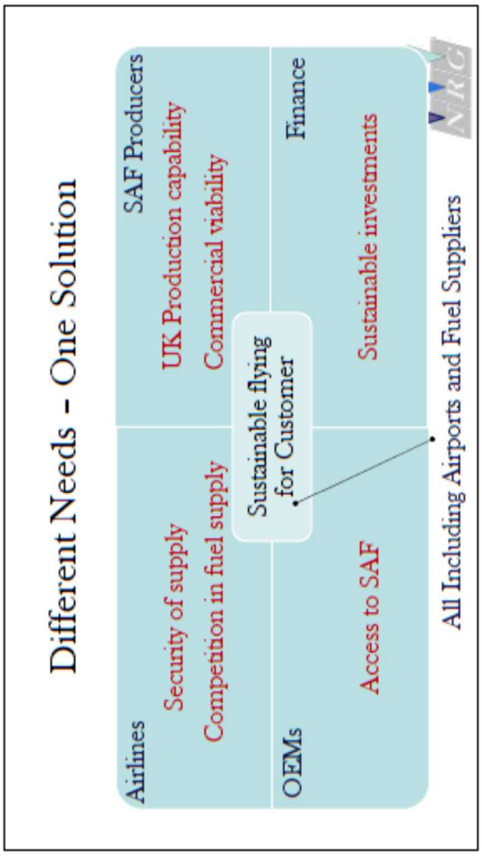
V1.1 31 August 2021

A5, Project Results Presentation

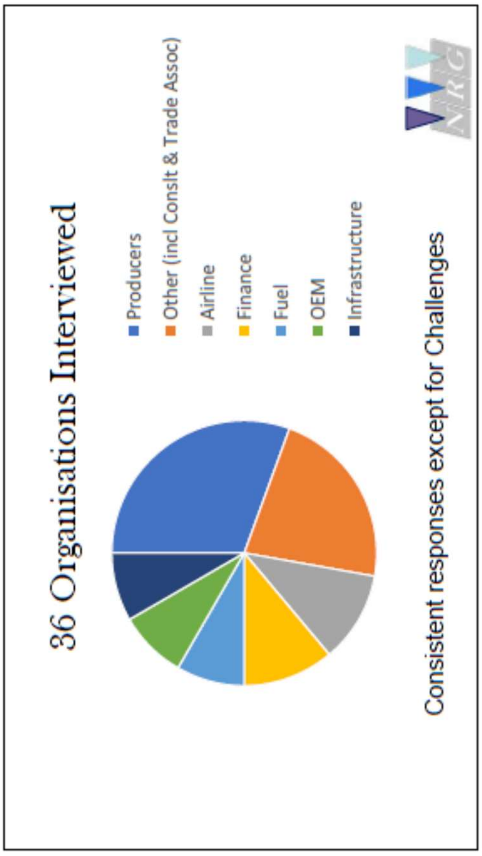
1



2



3



4

Mandate Alone Will Not Deliver SAF

- ∇ Promotes market competition (Market expansion, Rewards delivery)
- ∇ Investable (Cost control, Risk allocation)
- ∇ Value for money (Stops double dipping)
- ∇ Reduces support over time
- ∇ Compatible (Consistent)
- ∇ Technology agnostic
- ∇ Size agnostic
- ∇ Avoids unnecessary complexity (Simple)

Promotes market development excluded as Mandate covers

5

Advantages & Disadvantages

	Capital grants	Fixed payments	Certificates	Rating Schemes	Mandates	Tax breaks	RAB	CfD
Rewards delivery	X	√	√	X	√	X	√	√
Who funds	Tax payer	Flexible	Polluter	na	Polluter	Tax payer X	Polluter	Flexible
Stops Double dipping	X	X	X	√	√	X	√	√
Cost control	X[1]	X	X	X	X	X	X	√
Risk allocation	X	X	X	X	X	X	X	√
Market expansion	X	X	X	X	√	X	√	√
Consistent	X	X	√	?	√	X	?	√
Simple	√	√	√	√	√	√	XX	X

1. Can partly manage by auctioning contracts but has other challenges

6

Before the Challenges, some Answers?

Isssue		But.....
Hydrogen Business Model principles	✓	Speed of implementation
FOAK/ UKIB	✓	Unproven

✓ = Almost all interviewed agreed

Two issues to be solved independently
- How is UK SAF production incentivised
- Who pays

7

Dilema CfD or Something Quick

Issues		Solutions
CfD supported	✓	Sceptics concerns need to be addressed
CfD is complex		Start now and move quickly
- 2 consultations and legislation - All challenges need to be resolved		Find and Implement a simple interim approach that avoids challenges
What is quick?		
- Production tax credits but are they investible		Offer contracts

DfT, BEIS, Treasury to identify quick [interim measures]
Industry to draft term sheet(s)

8

Challenge #2 How Funded

Issues	Solutions
APD or ETS (EU+ only), Hypothecation and not linked to all polluters	Treasury view on ETS and APD
Fuel levy, International reaction	Change APD/ETS/Levy mix so fuel levy covers CfD and £ to Treasury OK.
Mandate Buyout, not enough	Part solution only
Tax payer contributes as well as polluter	UK GDP impact only

DfT make proposals to Treasury to identify what works
Industry to model outcomes

9

Challenge #3 Sustainability

Issues	Solutions
Appropriate for contract life	Shorter contracts
- Incentive to improve - Customer perception changes	Commercial equivalence re-opener Specify improvements in contract Pay per CO_2 saved Invest in waste optimisation
SAF availability	Apply principles not lists
Feedstock market distortions	Exclude feedstock close to regional capacity

Industry establish rules that are consistent with other schemes but properly measure sustainability.

10

Challenge #4 Indexation

Issues	Solutions
CPI, relevant?	Only if costs less to government
Feedstock non fungible	SAF producers manage
Inputs that are or become fungible (eg Power, ethanol or Hydrogen)	Ensure they become commodities and then allow indexation
Inputs that government controls (eg Waste)	Indexation to manage costs

Industry to demonstrate that indexation reduces cost to CfD Counterparty.
Decide if simpler to remove all indexation.

11

Answers part 2

Issue	Answer – General consensus
Reference price	Achieved sales price & agency that auctions
Contract allocation	Negotiation at start then auction
Technology/ Feedstock pots	Approach as for electricity
Change in Sustainability requirements during contract	Change can be requested but must be commercially equivalent
Contract length	15 years
Increase in production capacity	Limited flexibility in contract but then gain/ share
Risk allocation	As per Hydrogen principles
Penalties for early contract failure	Bid bonds
Underwriting of contract by CfD Counterparty	Regulatory arrangement as per electricity

12

Next Steps

- Decisions to be made as per challenges slides
- DfT to decide on next steps (Consultation?)
- Industry/ Government to agree to phase 2 (Secondment)
- NR complete report and other deliverables
  - CfD – What you need to know
  - Model of SAF £ flows

13

Back Up

14

Jet Zero programme

15

A6, CfD Cash Flow model

Year		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2050
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	29
£ value as per year																		
How could a SAF CfD be paid for?																		
Mandate %		0%	0%	0%	1.5%	2.3%	3.1%	3.9%	4.7%	5.5%	6.3%	7.1%	7.9%	8.7%	9.5%	10.3%	11.1%	22%
Mandate quantity 000 mt	000 mt	0	0	0	180	274	367	458	548	637	724	811	896	979	1062	1143	1224	2163
Buy out price £/kg of fuel	£/kg				1.57	1.54	1.51	1.48	1.45	1.42	1.39	1.37	1.34	1.31	1.29	1.26	1.24	0.96
Buy out receipts	£m pa	0	0	0	58	202	338	149	277	398	213	327	435	161	264	362	0	0
SAF selling price	£/tonne				1939	1922	1906	1890	1875	1861	1847	1835	1823	1811	1801	1791	1782	1797
CO2 Value £2018	£/tonne CO2e	27	34	41	47	54	61	67	74	81	88	96	103	111	118	126	133	231
CO2 Value £ of the day	£/tonne CO2e	29	38	46	54	63	73	82	92	103	114	127	139	152	165	180	194	435
Carbon permit revenues	£m			214	493	861	1313	1442	1612	1787	1910	2110	2292	2434	2619	2831	2898	5199
CO_2 used pre SAF saving	million tonne CO2	50	49	49	48	48	48	47	47	47	46	46	46	46	45	45	45	41
Air Passenger Duty	£m	3556	3487	3418	3351	3285	3221	3158	3096	3035	2976	2917	2860	2804	2749	2695	2642	2043
Compare sources with "Total CfD costs" below																		
Cost of SAF CfD																		
Additional SAF CfDs in place					2			3			3			4			6	14
CfD price in current contracts	£/tonne				2593			2412			2231			2051			1870	
Average CfD price	£/tonne	0	0	0	2593	2644	2697	2548	2599	2651	2493	2543	2594	2413	2461	2511	2297	
SAF produced	000 tonne pa	0	0	0	143	143	143	357	357	357	571	571	571	857	857	857	1286	2286
UK fuel loadings	000 tonne pa	12334	12162	12077	11992	11908	11825	11742	11660	11578	11497	11417	11337	11258	11179	11101	11023	10061
UK SAF as % of fuel usage	%	0%	0%	0%	1%	1%	1%	3%	3%	3%	5%	5%	5%	8%	8%	8%	12%	23%
SAF used in UK	000 tonne pa	0	0	0	143	143	143	357	357	357	571	571	571	857	857	857	1286	2286
Aviation fuel price excl CO2 costs	£/tonne	486	506	516	526	536	547	558	569	581	592	604	616	629	641	654	667	863
Aviation fuel price incl CO2 permit	£/tonne	595	643	681	716	755	794	829	868	908	948	992	1033	1077	1118	1163	1205	1797
Total CfD costs pre mandate premium	£m pa	0	0	0	268	270	272	614	618	622	883	886	892	1145	1151	1155	1405	
Fossil + C revenue to CfD holders	£m pa	0	0	0	102	108	113	296	310	324	542	567	590	923	958	997	1549	
Market revenue to CfD holders	£m pa				277	275	272	675	670	665	1056	1048	1042	1553	1543	1535	2291	
CfD cost excl SAF buy out premium	£m pa				93	103	113	235	258	282	369	405	441	516	566	617	663	
CO_2 saved (note % increases in 2031)	000 tonne CO2 pa	0	0	0	404	404	404	1011	1011	1011	2310	2310	2310	3465	3465	3465	5197	9239
Unit cost of intervention (CfD)	£/tonne CO2				663	668	673	607	612	616	382	384	386	330	332	333	270	
CO2 % saved versus 2022															91%			
CO_2 used post SAF saving	million tonne CO2 pa	50	49	49	48	48	47	46	46	46	44	44	44	42	42	41	39	31

Calculated figure
Includes an assumption
Input

Methodology used to derive SAF cash flow model

Assumptions

All assumptions and their sources are listed in the Assumptions tab. See below. The key subjective input assumptions are actual assumptions are shown in **bold**:

- *SAF contract price*, also known as strike price, and how this price changes with each contract round. Initial **SAF contract price** is quoted in $ and includes **£/$ exchange**
- The volume of *SAF produced* and contracted under the CfD, note this is input as **Additional SAF CfDs in place** in each round multiplied by **SAF produced per CfD**
- **Mandate buy-out payment,** this is incorporated in the calculation as shown below. Not all parties agree that the SAF market price will be influenced by the mandate, see 3.4. To remove the impact of the mandate buy-out payment, **Impact** should be set to 0%.
- **Carbon prices**
- **Carbon permits auctioned**

Outputs

The key outputs, all outputs are shown in italics, include the following:

Total CfD costs pre mandate premium calculated as *SAF produced* and contracted within the CfD x (*Average CfD price – Aviation fuel price incl CO2 permit*). *Average CfD price is the Average CfD price* across all rounds to date. *Aviation fuel price incl CO2 permit* is calculated as *Aviation fuel price excl CO2 costs + CO2 Value £ of the day***.** *CO2 Value £ of the day* is calculated as **CO2 Value £2018 x CPI inflation.**

CfD cost excl SAF buy-out premium calculated as *SAF produced* and contracted within the CfD x (*Average CfD price – SAF selling price*). *SAF selling price* is calculated as the greater of (**Buy-out price** x **SAF price versus Buy-out +** *Aviation fuel price excl CO2 costs* or *Aviation fuel price incl CO2 permit)*

These costs can be compared with the following:

Buy-out receipts, calculated as (*Mandate quantity – SAF used in UK*) x **Buy-out price**. If the *SAF used in UK* > the *Mandate quantity* then the *Buy-out receipts* are nil. Also it is not yet certain that there will be a mandate buyout. The *Mandate quantity* is calculated from the **UK Fuel loadings** x the *Mandate %*. Note that *Mandate %* is increased each year by the **Annual arithmetic increase.** In the model from 2025 onwards it is assumed that the *SAF used in UK* is equal to the *SAF produced* within the CfD.

Air Passenger Duty

Other Inputs and Calculations used

Annual change in UK Fuel loadings, Tonne of CO2 per tonne of fuel, CO2 savings pre CCS, CO2 savings round 3 on, Aviation fuel market price,

Aviation fuel excl non transport CO2 calculated based on **CO2 per tonne of fuel** – **CO2 aviation element only**

Carbon permit revenues are calculated from (*Carbon used pre SAF saving – CO2 saved*) x *CO2 value* x **Carbon permits EU & Domestic %** x **Carbon permits auctioned %.** *Carbon used pre SAF saving* is **CO2 per tonne of fuel x UK Fuel loadings** and *CO2 saved = SAF produced* x **CO2 savings.**

UK SAF as % of fuel usage = SAF produced **/ UK fuel loadings.**

Fossil + C revenue to CfD holders = Aviation fuel price incl CO_2 permit x *SAF produced.*

Market revenue to CfD holders = SAF selling price x SAF produced.

Unit cost of intervention = Total CfD costs pre mandate premium / *CO_2 saved*

CO_2 used post SAF saving = Carbon used pre SAF saving – CO_2 saved

Version 5	Units		Sources
Value	£ of the day		
UK Fuel loadings	000 metric tonnes	12334	= 2019 DUKES
Annual change	%	-0.7%	DfT High Ambition inc to 60.8 mn tonne CO2 for passenger kms by 2050 Efficiency, C pricing and zero emission aircraft give
			-28 mn tonne CO2 of 2050 or 78% of 2020. So delta vs 2020 is 5.2 mn Tonne CO2 or 13.6% = 0.7% pa
Mandate % pre CfD	%	0.0%	Low but so as to encourage setting up facilities excl production
Mandate % post CfD	%	1.5%	RTF 11%, obligation % total % is presumably less due to minimum size
Annual arthimetic increase	%	0.80%	RTF increases by 0.2% in similar period and is 14% by 2032
Air Passenger Duty	£m	£3,700	2019/20 OBR forecast
APD changes			assume no inflation increases so falls in value in £ of the day
Minimum size of user	Not used in current model		
Mandate buy out payment	£/kg fuel	1.7	100% Impact in calcn Not increased with inflation stays at 2021 value
			Assumed similar to RTFO Advanced fuel buy out
SAF price versus Buy out	%	90%	
Tonne CO2 per tonne of fuel	Tonne CO_2e/tonne	4.04	93 gCO2e/MJ (average EU from 2017.03) x 43 MJ/kg divide by 1000 for tonne/tonne
CO2 saving pre CCS	Tonne CO_2e per tonne of fuel	2.8	70% as per SA Roadmap
CO2 saving round 3 on	Tonne CO2e per tonne of fuel	4.042	100%
SAF contract price, year 1 (2025)	£/metric tonne	2593	NR proposal, FiDER contract price was 140 vs wholesale price of 42 £/MWh
SAF contract price, year 3	£/metric tonne	2412	Based on % reduction in C29
SAF contract price, year 5	£/metric tonne	2231	
SAF contract price, year 7	£/metric tonne	2051	
SAF contract price, year 9	£/metric tonne	1870	95% of market price with permit 2525 $/tonne
Annual Cost reduction	%	4%	Engines that Move Markets
CPI inflation	%	2%	
Aviation fuel market price	£/metric tonne	510	Assume non transport element already requires permits, 2019 average in $ and converted using £/$ below
Aviation fuel excl non transport CO2	£/metric tonne	486	Assumes aviation element only is 3.15 tonne CO2e/ tonne of fuel
Number of SAF projects in each round	see table		NR proposal
SAF production per CfD	000 metric tonnes	71	SA Road map
UK SAF usage	000 metric tonnes		= SAF produced
Admin cost of CfD	Not included in this analysis		Obtain estimate from LCCC
Carbon prices	£2018/ tonne CO2e see table		BEIS carbon price for UK public policy appraisal, central This data source was current when this spreadsheet was produced.
			On 2 September 2021 new Carbon values for policy appraisal were issued which are significantly higher.
£/$ exchange		1.35	Typical value over last 12 months
SAF imports			Estimate included in table for pre CfD, 0 thereafter
Carbon permits EU & Domestic %		38%	% of passenger kms ex UK covered by ETS scheme i.e. EU+ only. CCC (2020.12.09 6th report) based on CAA data Dom 2%, Shorthaul 40%,
			Longhaul 57%. NRG est 1) Shorthaul 90% EU of 40% = 36% and 2) CORSIA 80% of Long Haul round to 100% by increasing largest.
Carbon permits auctioned 2024		25%	UK ETS but timing as per EU
Annual increase 2025 to 2027		25%	

A7, Nic Rigby CV

NICHOLAS RIGBY

Profile Advisor to start ups in the energy sector. An engineer with 40 years commercial experience in the energy industry and a management consultant working across a broad spectrum of industries. Significant asset and contract management experience leading large teams of 20 contract managers. Key dispute resource either as expert witness or dispute project manager. Associate Member of Chartered Institute of Arbitrators. Experience of setting up three start ups.

Career Details

Jan 2016 on: CEO NRG Management Consultancy Ltd, Re-established NRG Management Consultancy to provide Contract Management/ Legal support services and advise energy related start ups. Acting as Expert Witness and project managing disputes. Resolving energy related disputes via negotiation or arbitration/litigation. Commercialising start ups by monetising their value offer and identifying routes to market. Advisory Board member to Cumulus Energy Storage and BH Energy Gap.

2014 – 2015: Head of Contract Management, Low Carbon Contracts Company Ltd, Established team of 6 contract managers and systems to manage complex 15 year + contracts. Managing 41 contracts across all low carbon technologies with a total value of £20bn. Low Carbon Contracts was set up and owned by DECC but works as an independent commercial organisation implementing policy using private law contracts.

2014 Jan-Apr: CEO NRG Management Consultancy Ltd, as above. Provided commercial advice to enable a novel energy storage concept to monetise their product offer. Used wider knowledge of the electricity industry to identify and quantify revenue streams.

2013: Head of Contract Management, RWE Innogy Working on 2 disputes (Kvaerner – Jackets, Siemens – Offshore Sub Station) on German wind farm and re-organising Contract Management activity. Developed policies and implemented procedures to prevent future disputes. Managed team of 20 Contract Managers and 4 administrators. Worked over 3 major projects (Galloper procurement strategy and team development, Gwynt y Mor contract placement and management, Nord See Ost contract and dispute management). Developed future contract strategy across all renewables including reducing number of contract forms used for similar activities, future direction was focus on FIDIC.

2011- 2013: Dispute Director, RWE Innogy GmbH, Successfully managed construction dispute between Greater Gabbard windfarm (50% owned by RWE) and Fluor (FIDIC based contract). Fluor were claiming £300m for additional works and client imposed delays. Managed all technical issues in the dispute including collecting evidence and expert witnesses. Arbitration panel threw out Fluor's claim principally on technical grounds. Counterclaim against Fluor re defective welding settled by negotiation. Prepared and issued ITTs for multi £m offshore NDT works and carried out evaluation and negotiations pre award of NEC contracts.

2008 – 2010: Head of Strategy, RWE Innogy GmbH, Following the establishment of a single RWE renewables company my role was expanded to include Strategy for all European renewable activities. Recruitment of a multinational team of 6, developed strategy plan for all renewable technologies. Including support of Corporate Venture Capital business with investments in small wind, marine turbines and biomass start ups.

2004 – 2008: Head of Strategy, npower renewables, Established strategy and agreed with RWE main board. Implemented policies and procedures, including creating a methodology for forecasting renewable energy prices. Developed lobbying strategy in relation to government funding for offshore wind with successful outcome. Director of BWEA (now RenewableUK). Led team developing 2020 UK renewable strategy and used this work to develop a proposal for RWE to transform the Company wide renewables strategy. Selected by the Energy Minister to join the Renewables Advisory Board due to pioneering work on grid access issues. Member of Electricity Network Strategy Group.

2001-2004: Energy Marketing Manager, RWE Trading GmbH, Negotiating and implementing complex contracts in relation to RWE's traded products (power, gas, coal, environmental products) and services in liberalised European markets. Specialising in asset related deals and Route to Market services, including a gas marketing deal described as innovative by the FT. Delivering big ticket contracts (£1m to £10m pa). Negotiated a wide variety of contract types including PPA, coal purchase and supply, trading services agreements and purchase of gas storage project.

2000- 2001: Asset Manager, Innogy plc Following involvement in the team that successfully sold National Power generation assets. Development of asset strategy in terms of buy, invest, optimise, sell. Evaluating power station asset opportunities in relation to generation and trading. Optimising cost base so as to demonstrate best in class in power station asset management, measured in profit delivered. Influencing strategy at all levels from Board to plant operator.

1992- 2000: Grid Services Manager, National Power PLC, Commercial Services, Recruitment of team to negotiate energy, transmission support service (1994/95 Income £150m, Costs £100m) and use of system contracts with National Grid Company. Optimising profits through contract performance. Major focus on contract dispute resolution including case taken to Commercial Court of Appeal. Led a strategy group of 10 senior managers as part of National Power's 1999 strategy review of decision whether to purchase a DNO (Distribution Network Operator). Identified smart meters as a Unique Selling Point for National Power. Negotiated numerous grid connection agreements and ancillary service agreements.

1991-1992: Market Development Officer, National Power PLC, Commercial Division, Managing domestic supply marketing programmes (including joint programmes) with total value of £1m pa. Monitoring consumer requirements and whether new applications such as heat pumps had a role in the domestic sector.

1988-1991: Director of Consulting, NRG Management Consultancy, Business start up of NRG (5 employees) to carry out marketing and technical assignments in the energy and related sectors. Assignments included several JV pan European studies including evaluation of supply of all domestic Heating & Ventilating equipment including boilers, heat pumps and solar thermal. Created entirely new customer base with innovative marketing products and migrating solutions across industry sectors. Concurrently Director and minority owner of a £2m turnover engineering company, Rigby and Mellor.

1986-1988: Senior Consultant, March Consulting Group, Selling, supervising and carrying out energy management and marketing assignments and project managing a £1m programme of works including work on multiple small commercial buildings. Responsible for a regional energy strategy study incorporating analysis of domestic energy usage and energy efficiency measures including use of renewable energy. Acted as Commercial Director creating a credible sales strategy for a Start up with an energy control product.

1983-1986: Business Manager, Endless Holdings, Developing a start up £0.5m p.a business selling a lighting control system. Including setting up agencies outside of UK.

1980-1983: Energy Management Consultant, PA Management Consultants, Capital Projects Division, Implementing major energy cost reduction programmes across various property portfolios including small commercial buildings and domestic residences. Evaluation of early energy management systems.

1976-1979: Production Line Manager, Coles Cranes, Re-establishing control on behalf of the company in an environment where unions "managed" the shop floor, responsible for 60 production staff.

1969-1976: Undergraduate Apprentice and Section Leader Project Control, Rolls Royce, Responsible for negotiating joint programmes with French Partner company.

Directorships

NRG Management Consultancy Ltd, CEO	1988 – 1991, 2014 & 2016 - current
Rigby and Mellor Ltd, Non-executive	1991 - 1994
npower renewables Ltd, Commercial Executive	2006 - 2008
Brockloch Rig Windfarm Ltd, Commercial Executive	2006 - 2008
British Wind Energy Association Ltd, Non-executive	2007 – 2009
Energy Institute, Membership panel	2006 – 2020
Deputy Chairman of Membership panel	2016 - 2020

Educational Qualifications

Mechanical Engineering IIii, Bristol University (BSc)

Part One Diploma of Management Studies, Bristol Polytechnic

Chartered Engineer (CEng), Fellow of the Energy Institute (FEI) and European Engineer (Eur. Ing.)

Associate Member Chartered Institute of Arbitrators (AMCIArb)

Cardiff University Bond Solon Expert Witness Certificate, Civil Law

Contact Details

E mail: nic@consult-nrg.co.uk

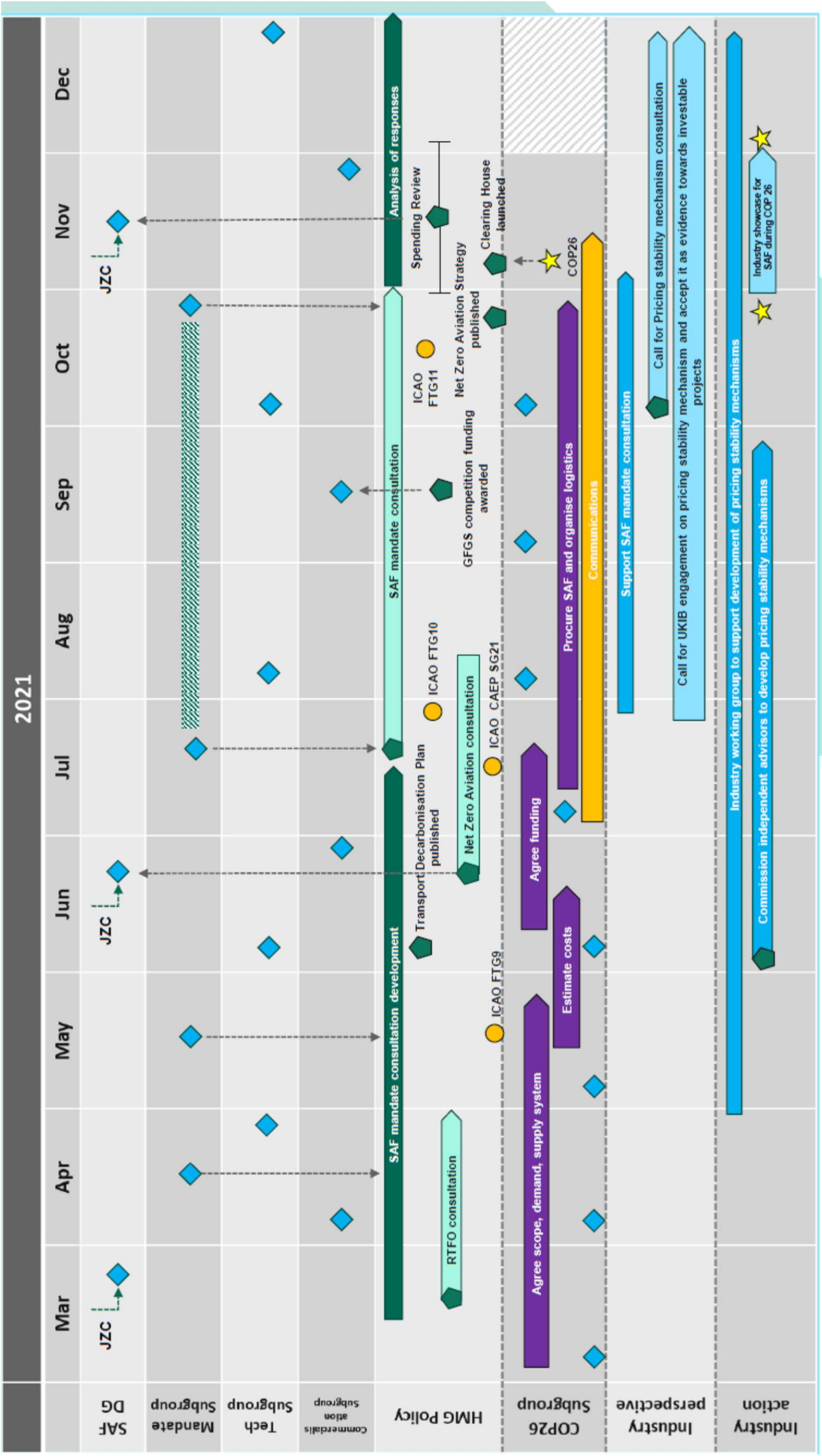
A8, List of companies interviewed

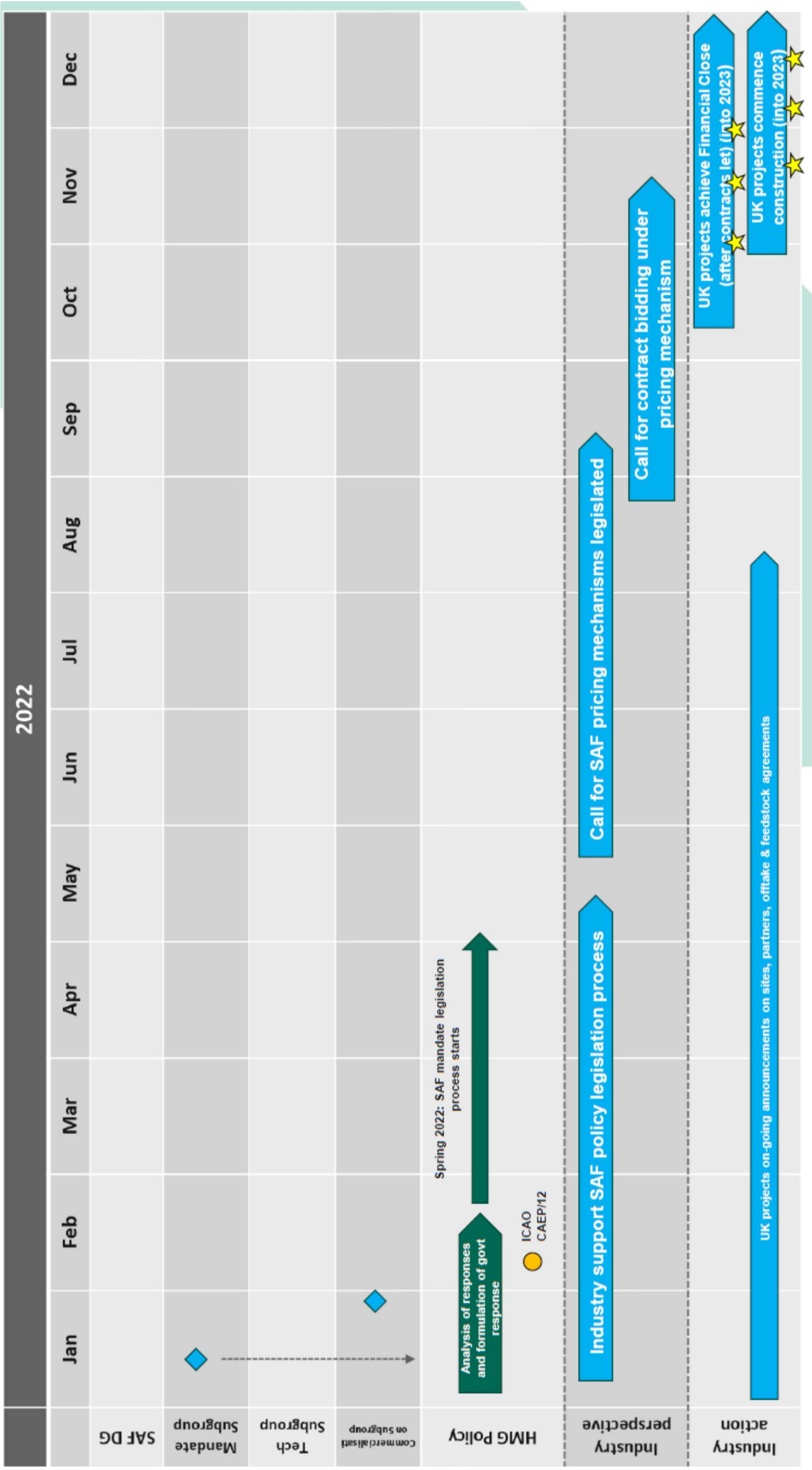
SAF Producers	Other (incl Consultants and Trade Associations)	Airlines
Velocys Wastefuel Neste Argent Fulcrum Lanzatech Alfanar Ensus Carbon Engineering Johnson Matthey	Sustainable Aviation Renewable Transport Fuel Association Association for Renewable Energy and Clean Technology In Perpetuum Transport & Environment Dept for International Trade Consultant (anonymous) Ministry of Defence BH EnergyGap Broadmanor Consulting	Virgin International Airlines Group easyjet Loganair

Finance	Fuel	OEMs
HSBC Aviva Fluid ice Anonymous	Phillips 66 Shell BP	Rolls Royce Boeing Airbus

Infrastructure
Gatwick Airport Heathrow Exolum

A9, Jet Zero Programme




2022
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
SAF DG
Mandate Subgroup
Tech Subgroup
Commercialisation Subgroup
HMG Policy
Industry perspective
Industry action
Analysis of responses and formulation of govt response
ICAO CAEP/12
Spring 2022: SAF mandate legislation process starts
Industry support SAF policy legislation process
Call for SAF pricing mechanisms legislated
Call for contract bidding under pricing mechanism
UK projects achieve Financial Close (after contracts let) (into 2023)
UK projects commence construction (into 2023)
UK projects on-going announcements on sites, partners, offtake & feedstock agreements

A10 Evaluation of Support Mechanisms

Comparison of principles used in this report and the questionnaire versus those used in the CfD – What you need to know presentation.

Principles included in hydrogen consultation	Principles used in early analysis on project
Promotes market competition	Market expansion, Rewards delivery
Investable	Cost control, Risk allocation
Value for money	Stops double dipping
Reduces support over time	
Compatible	Consistent
Technology agnostic	
Size agnostic	
Avoids unnecessary complexity	Simple

Outcome of original analysis.

Advantages & Disadvantages

	Capital grants	Fixed payments	Certificates	Rating Schemes	Mandates	Tax breaks	RAB	CfD
Rewards delivery	X	√	√	X	√	X	√	√
Who funds	Tax payer	Flexible	Polluter	na	Polluter	Tax payer X	Polluter	Flexible
Stops Double dipping	X	X	X	√	√	X	√	√
Cost control	X[1]	X	X	X	X	X	X	√
Risk allocation	X	X	X	X	X	X	X	√
Market expansion	X	X	X	X	√	X	√	√
Consistent	X	X	√	?	√	X	?	√
Simple	√	√	√	√	√	√	XX	X

1. Can partly manage by auctioning contracts but has other challenges