Department for Transport

Advanced Fuels Call for Evidence: Summary of Responses

April 2014

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1. Advanced Fuels Call for Evidence: Summary of Responses

Introduction

The advanced fuels call for evidence ran from 12 December 2013 to 21 February 2014. We received a total of 60 responses:

Table 1.1	
Industry	25
Representative organisation	16
Aviation	7
Scientific	5
NGO	3
Individual	3
Advisory	1

The respondents were predominantly advanced fuel producers, first generation biofuel producers and industry representatives. The names of respondents are listed at the end of this document.

Transport Sectors

Chapter summary

This chapter of the call for evidence looked at the potential of advanced fuels in transport sectors that cannot be easily decarbonised without low-carbon fuels (i.e. aviation, shipping, freight and rail). We asked whether support for advanced fuels should be targeted at particular sectors. We also sought evidence on the uptake of advanced fuels in these sectors.

Government response summary

We recognise the long-term need for advanced fuels in these sectors and will continue to discuss this in more detail with stakeholders.

Q1: Should the government focus support for advanced fuels in certain transport sectors? If so, why?

1.1 34 respondents said yes, 6 disagreed and 20 did not provide a response.

1.2 There was wide consensus that transport was a priority sector. However, respondents who favoured a focus were split on which sectors to support (some respondents chose more than one sector):

Table 1.2	
Road	8
Aviation	14
Maritime	10
HGVs/freight	12
Neutral approach	5

1.3 Some argued that the government should instead let decarbonisation follow least-cost pathways.

1.4 8 respondents argued for an explicit focus on the road sector (not including freight). There was more support for a focus on areas that did not have alternatives to low carbon liquid fuels, such as aviation, maritime and HGVs. Respondents from the aviation industry argued that aviation should be eligible for incentives and needed support.

1.5 Two respondents argued that a short-term priority should be sectors able to deliver immediate greenhouse gas emissions savings, particularly towards binding EU 2020 commitments, and only then in the medium-term focus advanced fuels in sectors (such as aviation) that have few other decarbonisation options.

Q1a: What are your views on the government's analysis of the use of advanced biofuels in different transport sectors, as set out in the UK Bionergy Strategy? Are you aware of alternative estimates of the future uptake of advanced fuels in each transport sector?

1.6 It was pointed out that the Bioenergy Strategy[1] made no assessment of policy or support mechanisms, and as such was essentially an estimate of technical potential. Some new fuels and processes were either not included or, in the opinion of the respondent, were underestimated. A review of the analysis and an evaluation of current progress were suggested.

1.7 One respondent felt that the Strategy overlooked the freight sector and the possible savings from biomethane and natural gas. Due to the focus on bioenergy, the Strategy did not examine the potential of non-organic waste and renewable synthetic fuels. One respondent thought more attention should be paid to algal processes.

[1] https://www.gov.uk/government/publications/uk-bioenergy-strategy

1.8 One respondent felt that concerns about the impact on food prices need to be fully addressed. Another responded that a more detailed analysis of sustainability and life-cycle carbon emissions was needed.

1.9 Other evidence cited were E4Tech's 2030 roadmap, analysis by UK H2 Mobility for hydrogen and Sustainable Aviation's position papers.

Q1b: What physical and policy barriers are there to the uptake of advanced fuels in each transport sector?

Policy

1.10 The most common policy barriers listed were the lack of long-term policy certainty, the difficulty of accessing funding for new plants and the lack of a level playing field for incentives.

1.11 Numerous respondents highlighted the need for greater certainty in transport energy policy. A common argument was that current support is not long-term enough to give investors certainty and that, in addition, the highly variable value of Renewable Transport Fuels Certificates (RTFCs) means that they are not bankable as there is no clear price signal. Changing attitudes to conventional, crop-based biofuels were cited as an example of policy uncertainty. Some felt that support schemes are subject to review too early and often. The use of exclusive lists for feedstocks also meant support was changeable. Limited public support for R&D was also noted as a barrier.

1.12 The taxing of fuels on a volume basis was seen as a barrier to less energy dense fuels. Certain fuels, such as synthetic fuels or brown hydrogen, are not currently incentivised in the Renewable Transport Fuels Obligation (RTFO). Certain sectors, such as aviation and maritime are excluded. Some respondents noted that there was an imbalance between incentives for biomethane used in transport and heating.

1.13 A commonly noted barrier was the need for industry to develop agreed standards and specifications for advanced fuels, so that compatible equipment can be designed.

Physical

1.14 For some fuels, such as hydrogen and biomethane, the lack of refuelling infrastructure and suitable vehicles was cited as a major physical barrier.

1.15 Vehicle compatibility is an issue for biofuels as well, leading to calls to move to a 'flex fuel' standard, in which vehicles would be compatible with a wider range of blend levels. One respondent estimated that vehicles will need to be compatible with high biofuel blends by the mid-2020s, so promotion of compatible vehicles would need to be started soon.

1.16 Several respondents felt that a significant possible barrier was whether advanced fuel production could be scaled up to a commercial volume as further technical development is needed for many technologies, in particular in maritime. Feedstock supply/availability is another potential barrier, with limited supply of some. Respondents differed on whether developing certifications for higher blend levels would be a barrier.

1.17 One individual stated that advanced biofuels had a fundamental physical barrier in that more fossil fuel energy is used to make them than would

have been used if the fossil fuel had been burned directly and highlighted the need to do an independent life-cycle analysis.

Government Response

1.18 The government agrees that low carbon fuels will be essential in the medium to long-term to allow sectors such as aviation, maritime and freight to decarbonise. We will continue to develop options for providing government support for the use of low-carbon fuels in these sectors.

Fuels

Chapter summary

This chapter of the call for evidence focused on five advanced fuel technologies:

- Advanced biofuels
- Hydrogen
- Synthetic fuels from electricity
- Biomethane
- Nearly wholly renewable fuels

We asked whether government support was required for their commercialisation. We also asked what potential contribution these fuels could make to decarbonising transport and by when.

Government response summary

We accept that there is a role for government in encouraging the commercialisation of advanced fuels. We also intend to consult on:

- whether to extend support under the RTFO to hydrogen and synthetic fuels from electricity
- providing support for biomethane on an energy content basis
- equalising support for different types of biodiesel

Due to the risk of unintended consequences, we are not yet convinced by the case for extending support to fuels from fossil waste.

Q2: Is UK government support necessary to commercialise advanced fuel technologies? If so, why?

2.1 51 respondents said support was needed. One was not in favour and eight did not respond.

2.2 Respondents argued for the need for government support on the basis that the market will not deploy advanced fuels by itself because advanced fuels are more expensive than the alternatives, meaning there is no incentive for their use. Additionally, production facilities are at present seen as a high-risk investment. Respondents supported government action to achieve price parity and de-risk initial investments, allowing the sector to grow. Several respondents stressed the role of

government in coordinating deployment of fuels, vehicles and infrastructure over the long-term.

2.3 One respondent argued that there was no need for specific advanced fuel support, proposing instead a greenhouse gas emissions reduction target at lowest cost, linked to the EU Emissions Trading Scheme and the Fuel Quality Directive.

Q2a: What should 'advanced' mean? What role should process, feedstock and sustainability have in this definition?

2.4 There was no clear consensus on this question:

Table 1.3	
Focus on process innovation	20
Focus on feedstock	24
Focus on sustainability	31

2.5 High sustainability was the most frequently cited criterion, though respondents disagreed as to whether that should just mean a high greenhouse gas saving (60%+) or include additional sustainability criteria applicable to all uses of biomass.

2.6 Several respondents felt that the term 'advanced' was unhelpful and suggested using 'sustainable' instead.

2.7 Four respondents specifically said that the definition should be technology neutral.

2.8 Many respondents were against a technology-neutral approach and argued in favour of a definition looking at technology and processes. According to these respondents, it is important that an advanced fuel is innovative. Others thought that innovation should be supported via a different mechanism.

2.9 In terms of feedstock, an issue raised was the possible impact on food. Some sustainability-focused responses also considered land use as part of their criteria. However, a problem noted with feedstock-based definitions, as with the European Commission's proposed Annex IX list of 'advanced' feedstocks[2], is that it is necessarily exclusive and leaves no scope for innovation.

Q2b: What economic opportunities are there for the UK in developing this industry?

2.10 Respondents listed numerous opportunities for the UK. Primarily they were avoided costs and additional benefits. One respondent reported that meeting our climate change targets by 2050 would cost £44-78bn

[2] http://ec.europa.eu/clima/policies/transport/fuel/docs/com_2012_595_en.pdf
The list is an annex to the Commission's proposal to amend the Renewable Energy and Fuel Quality Directives to account for indirect land use change. Biofuels made using feedstocks from the list are considered advanced by the Commission.

per year more without bioenergy. In transport the opportunity cost is £5bn.

2.11 One estimate cited was that the development of a UK bioenergy industry could also contribute £6-33bn to GDP up to 2050. Some respondents noted the particular benefit to the rural economy.

2.12 Hydrogen industry respondents estimated that Britain could have $1bn in 2020 and $19bn in 2050 of the global fuel cell market. Synthetic fuel suppliers noted that there is the additional benefit of being able to use such fuels to store excess electricity from intermittent renewable sources.

2.13 Further benefits listed included increased energy security, reduced fossil fuel dependence, high-tech jobs and the ability to export advanced technology.

Q3: What could advanced biofuels deliver, and by when?

3.1 Several respondents expressed doubt that advanced biofuels could deliver significant quantities by 2020. One commented that advanced biofuels as defined by the European Commission's proposed Annex IX list of approved feedstocks would deliver little by 2020. Another said that only the most developed biofuels would be realistic up to 2020. This meant fuels already at technology readiness levels (TRL) eight or nine, and so already commercialised or very close. Biofuels at these levels include first generation ethanol, fatty acid methyl ester (FAME) and hydrotreated vegetable oil (HVO).

3.2 Other respondents were more bullish. One NGO estimated that a biofuel industry using refuse-derived biofuels would be cost-competitive without further support and some agricultural and forest residues would need only modest incentives, due to the very low feedstock price. Using all sustainably available wastes and residues could deliver a technical potential of 16% of EU road fuel demand in 2030.

3.3 Producers of certain fuels, such as via bacterial gas fermentation or algae, argued that their technologies were ready for deployment now.

Q3a: Do you agree with E4Tech's assessment of the technology readiness (i.e. TRL) of different advanced biofuel technologies?

3.4 E4Tech's report was based on the Annex IX list of feedstocks proposed by the European Commission as part of the negotiations to account for indirect land use change (ILUC).

3.5 Of the 30 respondents who replied, 16 respondents agreed with E4Tech's assessment and 14 disagreed. Disagreements were split between thinking the assessment too optimistic and too pessimistic.

3.6 Several respondents noted that the assessment applied only to road transport and other sectors had significantly different readiness levels. A broad point raised was that the technical assessment risked being too optimistic, as actual development depended on government support.

3.7 Several respondents amended or included assessments of the TRLs for particular technologies.

Q3b: Do you agree with E4Tech's assessment on the availability of waste and residue feedstocks, and their estimated costs of advanced biofuels?

3.8 18 respondents agreed, 15 did not, and 27 did not respond. Many that did not respond said that they did not have enough information to give a considered response.

3.9 Several respondents disagreed with the assumptions. For example, one questioned why all other feedstock uses should take priority over transport and noted that there were significant greenhouse gas saving synergies to be found with fuel and power.

3.10 Extra criteria put forward by respondents included the security and concentration of the feedstock supply, consideration of socio-economic impacts and full life-cycle analyses of emissions. Several stressed the need for clear definitions of wastes and a better understanding of their current uses.

3.11 One respondent highlighted that wood products are not waste and already highly utilised by the wood panel industry. Some respondents listed feedstocks that were not in the original Annex IX list: halophytes, corn stover and grasses, crude sulphate soap and crude tall oil, tyres. Other respondents disagreed with the assessments of particular feedstocks. For example, municipal waste will not continue to have a negative cost once demand creates a value for it.

Q3c: Do you agree with E4Tech's proposed criteria for when an advanced biofuel should be supported?

3.12 23 respondents agreed, 10 disagreed and 27 provided no response.

3.13 Respondents therefore generally agreed with the assessment, though numerous improvements were suggested, including performing a sensitivity analysis, adding a consideration of technology or overall pathway, adding a simple definition of 'sustainable collection' of wastes and adding a minimum emissions savings threshold.

3.14 Respondents had a number of reasons for disagreeing with the criteria. One stated that it is not enough for a fuel to meet minimum standards, but that it must also be 'fit for purpose' in all circumstances. Another suggested adding a criteria for a commercial advantage to the UK. A trade body felt that there was insufficient attention paid to the potential for mitigating adverse effects, skewing the findings. An individual disagreed with the principle of biofuels. One respondent felt that the decision tree was too binary.

3.15 Other reasons for disagreement focused more on the Annex IX list itself, linking back to the discussion on what should be the definition of 'advanced'. One respondent argued that fuels from waste gases are not 'derived from fossil', as the carbon involved is a chemical reactant that cannot be substituted in industrial processes.

3.16 One respondent thought that the criterion for competing uses was counter-productive. The focus should instead be on the environmental performance of advanced biofuels as a value-added use of the waste. The market can then determine the most value-added use without

regulations if the feedstock sustainability standards are applied uniformly to other sectors.

Government Response

3.17 On the basis of the evidence received, the government accepts that some form of government intervention is needed to commercialise and deploy advanced fuel technologies.

3.18 There was no consensus from respondents on what 'advanced' should mean or the role of process, feedstock and sustainability in the definition. The government will consider a definition for advanced fuels in general in the context of developing options for an additional support mechanism for advanced fuels.

3.19 The ILUC negotiations are not yet concluded and so the feedstock list remains liable to change. The government will propose selection criteria for advanced biofuels as part of the competition for £25m of capital funding announced in August 2013[3].

Q4: What could hydrogen deliver as a transport fuel, and by when?

4.1 18 respondents thought that hydrogen had only long-term potential at best. 9 were not in favour of hydrogen at all, while 7 thought that hydrogen had some potential before 2030. Respondents who saw short- to medium-term potential for hydrogen were generally linked to the sector.

4.2 The benefits of hydrogen cited were low fuel consumption, virtually no emissions, a short refuelling time and a long range. Respondents noted that its production could be a way of storing intermittent renewable energy. Several respondents cited a report estimating a potential 1.6m fuel cell electric vehicles (FCEVs) in UK by 2030 with annual sales above 300,000. They would deliver 60% lower emissions by 2020, 75% by 2030 and be on the path to zero-carbon by 2050.

4.3 Many respondents cautioned that hydrogen was unlikely to make a significant contribution for several decades yet, noting that 'green' hydrogen from renewable sources was particularly far off. Though 'brown' hydrogen from fossil sources could be used in the short- to medium-term to put in place the necessary infrastructure, it does not offer substantial emissions savings.

4.4 Barriers to successful deployment listed by respondents included developing a cheap and efficient production method, putting in place a national storage and distribution network and having enough renewable energy capacity to generate large quantities of green hydrogen. While hydrogen was generally seen as having significant potential in the long-term, the barriers to deployment were considered to indicate the need for government support.

4.5 Two respondents noted that hydrogen has uses beyond FCEVs and could be used in combustion engines as a transitional measure. Another

[3] https://www.gov.uk/government/news/25-million-for-advanced-biofuel-demonstration-projects

way to deploy hydrogen in the near term would be to focus on fleet vehicles such as buses and fork-lifts.

Government Response

4.6 The government currently supports the deployment of hydrogen fuel through the UKH2Mobility forum. Evidence provided via the call for evidence suggests that increased support for hydrogen could deliver greater deployment in the medium-term. The government therefore intends to consult later this year on whether renewable hydrogen should be eligible for RTFCs within the Renewable Transport Fuels Obligation (RTFO).

Q5: What could synthetic fuels and fuels from fossil waste deliver, and by when?

5.1 It was noted by a producer that synthetic fuels and fuels from fossil waste are only limited by the availability of renewable energy and feedstock from industry. Generally respondents felt that synthetic fuels had potential but current planned volumes were low. One cited 2025 as a reasonable date for widespread deployment. One respondent stated that the pace of commercial deployment was contingent on policy.

5.2 There was a general view that such fuels were a pragmatic option in the short term, on the basis that the greenhouse gases would be emitted as industrial waste gases if not converted into fuel. However it was felt that these fuels should be required to meet the sustainability criteria in the Renewable Energy Directive if they are to be supported. The definition of the feedstock as a waste and its fate if not made into fuel were also raised as issues to be considered.

5.3 Support was not universal. One respondent cautioned that subsidising such fuels will increase emissions by increasing the profitability of the underlying industry. An NGO said that fuels made from fossil waste should not receive public support. Another respondent pointed out that fossil plastics acted as a very good carbon store and converting these plastics into fuels would lead to extra CO2 being released.

Q5a: How do we determine the extent to which synthetic fuels from electricity are renewable?

5.4 There was general support for a life cycle analysis of emissions. The emissions from electricity production would need to be considered. Several respondents called for some way of knowing the carbon footprint of the input electricity at a given time.

5.5 One respondent argued that, if it is assumed that the CO2 feedstock is a waste that would be emitted as industrial waste if not converted into fuel, the only net emission from the fuel comes from the emissions produced, on the margin, by the electricity grid. For this approach it is crucial that the feedstock is a genuine waste.

5.6 One respondent highlighted a concern around double-counting, as the renewable electricity might also be eligible for support.

Q5b: What information can you provide on waste fossil gas processes and their potential benefits and drawbacks?

5.7 Several respondents stressed the need to follow the waste hierarchy and only use genuine wastes. One respondent said that using CO2 from air is prohibitively expensive, and so it is best to use industrial waste sources. Another respondent stressed the need for a way to distinguish between fossil and biogenic waste gases.

Government Response

5.8 The government recognises the potential of synthetic fuels and intends to consult later this year on a methodology for support under the RTFO. Given the sustainability concerns around fuels from fossil waste, the government is not considering extending support to such fuels at this time.

Q6: What could biomethane deliver as a transport fuel, and by when?

6.1 There was a preference from respondents for using biomethane as a fuel for the freight industry and other fleet vehicles. One respondent stated that biomethane offers an 80% emissions saving compared to diesel.

6.2 A potential supply cited for 2030 was around 24-32TWh, which would be equivalent to 5% of UK gas demand or 5% energy use from vans, HGVs and buses. Another estimated that 33.8TWh of biomethane for transport could be generated with supportive government policy. Other respondents were cautious on supply, as a lot of production was small scale and not easily distributed nationally. Distribution, leakages and biomethane's lower energy density were also cited as drawbacks.

6.3 There was doubt from some respondents whether biomethane could be economically used in transport. Biomethane is upgraded biogas and it may be more economical to use the biogas without upgrading in heating or power, which also have decarbonisation targets. Current incentive structures encourage this, leading one respondent to call for a separate system to the RTFO. Furthermore, the volume basis of the RTFO disincentivises energy dense fuels such as biomethane.

6.4 One respondent estimated that by 2020 there could be some 400 anaerobic digestion plants, supplying 7-9TWh of biogas.

6.5 One respondent was sceptical of the sustainability of biomethane from waste, arguing that it is merely 'less wasteful' rather than truly sustainable. Others were concerned about the potential for leakage.

6.6 Several respondents suggested focusing on the use of gas in general (including fossil) and offering green gas certificates for the biomethane component in gaseous fuels. Biomethane could also be a feedstock for syngas, which could be converted into liquid hydrocarbon fuels.

Government Response

6.7 The government agrees that gaseous fuels, and biomethane in particular, can make a worthwhile contribution to decarbonising transport.

6.8 One of the concerns raised is that gaseous fuels currently receive relatively less support than liquid fuels per unit of energy. Under the

current system certificates are awarded per litre for liquids and per kilo for gases. Per kilo, the energy content of gaseous fuels tends to be both higher and of a broader range than that of a litre of liquid fuels. To address this disparity, we intend to consult later this year on providing support for gaseous fuels on the basis of their underlying energy content rather than their weight.

Q7: Which 'nearly' wholly renewable fuels are close to commercialisation?

7.1 There was broad support for treating HVO as wholly renewable, as FAME is. Currently FAME is treated as wholly renewable, despite containing around 10% fossil. HVO is around 99% renewable, but only receives support for the renewable portion. HVO is already commercialised.

7.2 Bio- or renewable methanol was also noted as close to commercialisation. One respondent said that there is substantial methanol supply potential from by-product hydrogen and favoured treating the hydrogen as partially or wholly renewable.

7.3 Several respondents drew attention to fuels from waste, such as municipal waste or tyres, and how they could be supported despite inevitably containing some fossil material.

7.4 One respondent noted that glycerine was close to commercialisation. Another stated that biofuels from wood could be considered renewable as long as the sustainability of the wood was assured.

7.5 Several respondents argued that brown hydrogen should be used until economies of scale justify the production of green hydrogen.

Q7a: What evidence do you have of the percentage of their inputs that are renewable?

7.6 A popular measure was to meter the amount and carbon intensity of electricity input used. While measuring and supporting only the biogenic proportion of feedstocks is one option, one respondent raised concerns about this approach if waste fossil gases are to be considered advanced. Life-cycle analyses were also put forward as an alternative.

7.7 Others called for a different system of accounting because fuels will always be only partially renewable if they use open market heat or electricity. This could be an incentive based on the renewable content or based on carbon savings achieved with some universal sustainability criteria applied. Another alternative proposed was CO2 cost per kWh.

7.8 A respondent stated that refuse-derived fuel is 60-65% renewable. Tyres range from 20-60% natural (and therefore renewable) rubber.

7.9 A respondent highlighted their view that the RTFO needed a methodology to account for the renewable element of co-processed fuels.

Government Response

7.10 Fuels from partially renewable sources are eligible for support based on the percentage of renewable feedstock. The government will consult later this year on harmonising support for FAME and HVO under the RTFO.

Support mechanisms

Chapter summary

In this chapter of the call for evidence we sought evidence on the effectiveness of a selection of support mechanisms for advanced fuels:

- Sub-targets
- Fixed-price support
- Multiple certificates within a supply obligation
- A carbon-linked supply obligation

As well as suggestions for other possible mechanisms, we sought views on the consequences of introducing a mechanism for advanced fuels.

Government response summary

Responses from stakeholders generally focused on the perceived need for policy stability and a bankable price signal. We recognise the merit of an additional support mechanism for advanced fuels and will continue to develop our thinking in this area in conjunction with external organisations.

Q8: What support mechanisms could effectively support the deployment of advanced fuels?

8.1 Many respondents stressed the need for a long-term and stable policy. Aside from the details of specific mechanisms, the need for a clear, bankable price signal and enough policy certainty to encourage investment was repeatedly stressed.

8.2 Aviation respondents called for aviation to be included within support schemes, but cautioned against a mandate. Another respondent advocated a way of accounting for carbon emissions at sea.

8.3 Several respondents called for support for first-of-kind plants, either through direct funding or through mechanisms such as loan guarantees. For hydrogen especially some respondents called for public funding to reduce the cost of FCEVs and establish a refuelling network.

8.4 However, there was stronger support for a technology neutral approach, such as a consistent carbon price signal across all emissions sources that would allow the market to pull through the best technologies.

8.5 A common element of multiple suggested support schemes was an equalisation of tax on an energy basis. Alternatively, fuel duty could be based on carbon emissions.

Q8a: If government intervention is necessary, should the focus be on 'market pull' or 'technology push'?

8.6 Only four respondents preferred a focus on a technology push. There were around 20 respondents in favour of market pull and another 20 advocated some kind of combination.

8.7 Respondents argued that market pull, with clear and long-lasting objectives, would ensure demand. The market can then push through the

most appropriate solutions. Another stated benefit of market pull would be that a technology push might miss some promising possibilities. Those in favour of a market pull did not discount the benefit of targeted support to boost certain technologies or overcome particular issues within a market pull framework.

8.8 A justification cited for a push for particular technologies was that a market solution is too early for fuels where sustainability and availability are not fully known. Some backed a tech push, saying that untapped biomass is not being used because of a lack of investment in R&D and pilot scale operations.

Q8b: Which of the listed mechanisms would be most effective? What alternatives have we missed?

8.9 Respondents generally supported options that gave greater price certainty. A sub-target/supply obligation and fixed price support were the most popular, both explicitly preferred by 11 respondents. A carbon linkage to an obligation in particular was thought to provide continuity through to 2030. Respondents generally called for a long-term signal, whatever the actual mechanism.

8.10 One respondent explicitly backed contracts for difference, with price setting following by auctioning. They argued that a fixed strike price would give a stable price and long-term support. Other respondents were unsure of how effective contracts for difference would be and urged caution.

8.11 Only two respondents were in favour of extending multiple counting. Criticism of multiple counting was generally due to the certificates' uncertain value and the impact of multiple counting on the supply of certificates. However, one respondent supported quadruple counting for biomethane.

8.12 8 respondents backed some form of carbon linkage within the support mechanism. Other respondents worried that it would become too bureaucratic.

8.13 Other recommendations included putting in place a chain of custody requirement, as for first generation biofuels, providing fiscal support for early stage demonstrations, creating a 'flex fuel' standard so that cars can use high-blend biofuels and having a single point of contact in government for advanced fuels.

Q8c: What factors would be key in your decision to invest in a UK advanced fuel production capacity? How would the listed mechanisms affect them?

8.14 Responses generally focused on: long-term, sustainable policy; some certainty regarding sustainability criteria and requirements; targeted financial support and incentives; and technical requirements such as feedstock supply. Some called for greater certainty on price signals.

8.15 Some respondents noted specific factors, such as a way of certifying green electricity supply, or a change in fuel duty from a volumetric basis.

Q8d: Are you aware of any risks, problems or unintended consequences which could arise from introducing these market mechanisms?

8.16 One respondent called for support only for used cooking oil, on the basis that new advanced biofuels still have too much uncertainty around them. Another advised performing comprehensive life-cycle analyses to determine GHG savings and careful setting of eligibility criteria to mitigate against any unintended consequences.

8.17 One respondent advised not subsidising technologies that will never become economic without subsidy. Another thought there was a risk that an industry dependent on government subsidy would develop.

8.18 Several respondents cautioned against multiple counting on the basis that it reduced market size and lowered the price of the certificates. One commented that with an advanced sub-target, it must be achievable. Otherwise, buy-out effectively becomes a tax on industry.

8.19 One respondent argued that hydrogen should be treated separately from other fuels, in part because of its infrastructure needs.

Q8e: How might each of these mechanisms interact with the current support offered for biofuels under the RTFO? What would be the likely consequences of this interaction? Would it be advantageous to offer both forms of support to advanced fuels, with a new support mechanisms acting in addition to the RTFO?

8.20 It was generally thought that an additional advanced mechanism could work alongside or within the RTFO. An incentive that reduced risk for the first plants (either fixed price or a long-term sub-target) was also called for. But some respondents advised not to introduce multiple simultaneous mechanisms.

8.21 One predicted impact would be the squeezing out of first generation suppliers, though respondents disagreed about whether this was desirable.

Government Response

8.22 The responses to the call for evidence highlight that there is no one clear answer to how to bring advanced fuels to market. A variety of potential mechanisms exist, each with different advantages and disadvantages. Further analysis is needed to better determine the most effective form of support.

8.23 The government will continue to develop a number of policy mechanisms in parallel, consulting further with external organisations.

Respondents

2gbiopower	International Air Transport Association
AB Sugar	ITM Power
Abengoa	Lanzatech
Air Products	Leaders of Sustainable Biofuels
Anaerobic Digestion and Biogas Association	Lloyd's Register
ATOC and the represented Train Operating Companies	Low Carbon Vehicle Partnership
BOC	Neste Oil
Boeing	Olleco
Borderline Fuels	Organic Drive
British Airways	Research Councils UK
Calor Gas	Renewable Energy Association
Carbon Recycling International	Rolls-Royce
Celtic Renewables	Shell
CO2Chem Network	Society of Motor Manufacturers and Traders
Enerkem	Solazyme
Engineering the Future	Sustainable Aviation
ePure	Thomson Airways
Esso	Total
Energy Technologies Institute	Trinity Sustainable Solutions International
EU Skills	UK Hydrogen and Fuel Cell Association
EU Water and Power	UK Petroleum Industry Association
Friends of the Earth	UK LPG
Freight Transport Association	UK Sustainable Biodiesel Association

Gasrec	UPM-Kymmene Corporation
Greener by Design / RAeS	Virgin
International Council on Clean Transportation	Volvo Trucks
Institute for European Environmental Policy	Wood Panel Industries Federation
Ineos	5 individuals also responded