

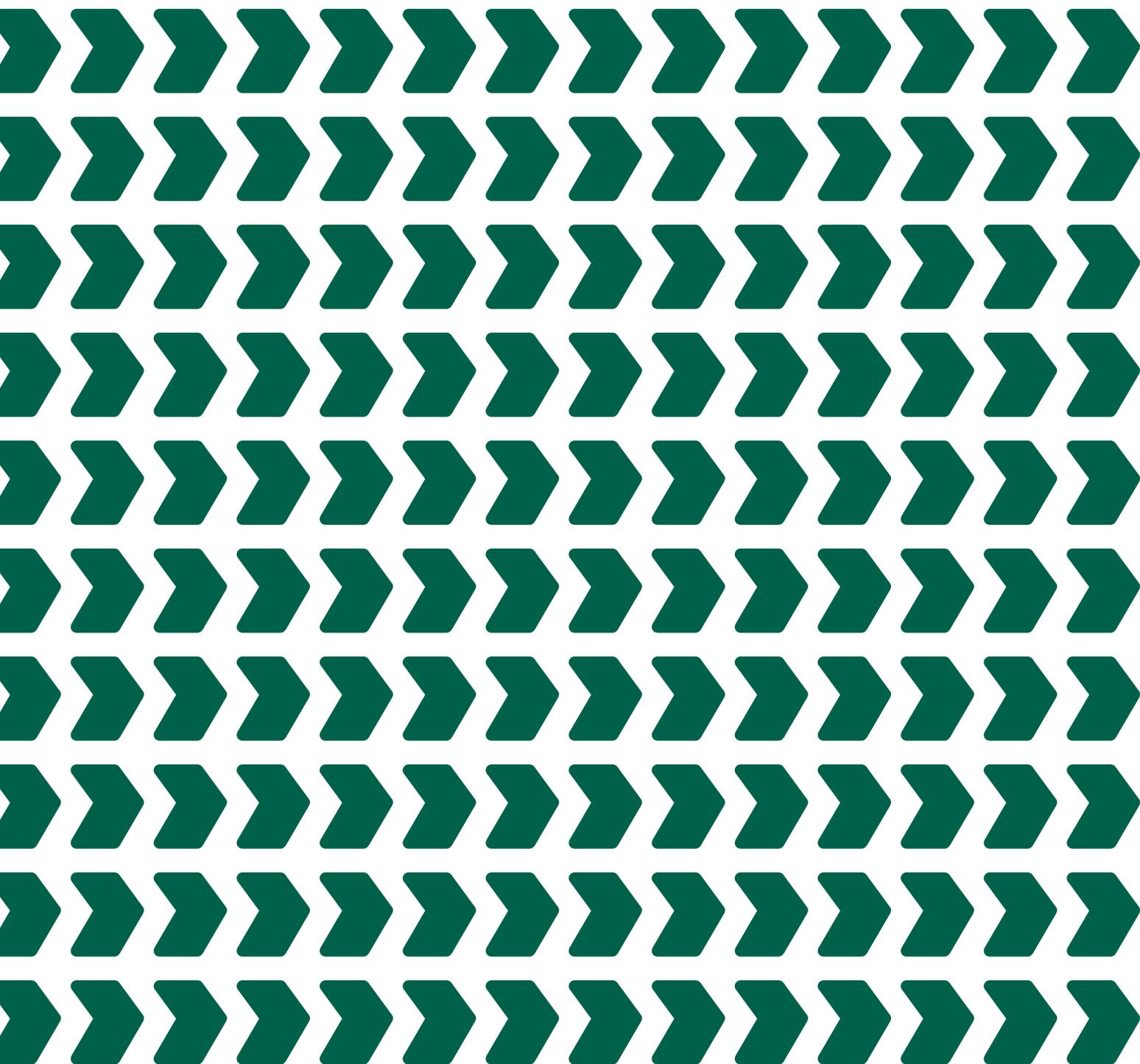


Department
for Transport

The Renewable Transport Fuel Obligations Order

Government response to the consultation on amendments

Moving Britain Ahead





The Renewable Transport Fuel Obligations Order Government response to the consultation on amendments

Presented to Parliament
by the Secretary of State for Transport
by Command of Her Majesty

September 2017



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Foreword: Jesse Norman MP



Renewable sources of energy are of ever greater importance if we are to address the challenges of climate change cost effectively.

The Government's 15 year strategy for renewable transport fuels is designed to build a firm platform for investment to develop sustainable advanced fuels for automotive, aviation and road freight.

We will maximise the industrial opportunities to be gained for the UK, by increasing our energy resilience through reducing reliance on imported fossil fuels. For the first time the market trading mechanism of the Renewable Transport Fuels Obligation will encourage technological innovation to develop and supply sustainable fuels for aviation.

I am very grateful to all those organisations and individuals who responded to our consultations on the amendments to the RTFO Order.

Our commitment to increase the contribution from renewable fuels over a long term was broadly welcomed. This commitment includes support for innovation in new carbon saving alternative fuels for planes and lorries, and for the development of fuels from wastes. Where stakeholders have expressed concerns, including as to the role of crops, we have listened and responded. We will continue to provide strong support for UK producers of renewable fuels where their fuels comply with the stringent sustainability standards we set and enforce.

Maintaining public confidence in the value of renewable fuels is all the more important at a time when the automotive industry's claims for environmental performance and compliance have been publicly challenged.

The sustainability requirements for renewable fuels, along with the further improvements set out in this Government Response should give the public extra confidence that the petrol and diesel they buy do genuinely deliver a lower carbon impact than 100% fossil fuels.

By the same token, the next steps set out in this Response should also provide the confidence needed by UK producers and the farms that supply them that their existing installed plant capacity will be fully utilised, and that there will be the

continuing demand in the UK needed to encourage investment in productivity and yield improvements. These improvements can drive down costs, improve efficiency and deliver even greater carbon savings.

At the same time, we are also making clear to industry the need for them to increase their use of waste sources and drive further technological advancement.

The Government is committed to reducing the impact of waste on our environment and supporting the transformation of wastes into fuel where this gives the greatest economic and environmental benefits. We have a large amount of waste in the United Kingdom, and the Government will develop further measures to see more of this domestic resource used for biofuels where that is consistent with our broader objectives to move towards a genuinely circular economy.

Economically, businesses and motorists rely on access to good quality fuels at a reasonable price. These legislative amendments should help ensure that industry increases the renewable content of fuel without a significant effect on prices.

Increasing the renewable content of petrol by moving to E10 fuel should make achieving our targets easier and potentially more cost effective, as well as providing an economic boost to domestic producers. The government will work with industry to facilitate any future introduction of E10 petrol, playing our part to ensure that it is managed carefully and to ensure ongoing availability of fuel suitable for older (pre-2000) petrol vehicles. In doing so, we expect the oil industry to do their part to help minimise any impacts on owners of older vehicles.

These changes will accelerate the delivery of sustainable alternative fuels for aviation, enabling the UK to lead in developing and deploying those fuels, alongside other high value sustainable heavy transport fuels and chemical products made from low value wastes.

Our legislative changes should also encourage a clear demand side pull in the UK market. But we recognise that capital investment support can play a critical role in generating additional domestic supply. That is why we have launched a second Advanced Fuels Competition already this year. The Future Fuels for Flight and Freight Competition (F4C) will provide up to £22 million to promote the development of an advanced low carbon fuels industry within the UK, including greater supplier capabilities and skills in relevant technologies, whilst maximising value for money for the taxpayer. Looking further ahead I would like to see an even greater focus on the use of domestic feedstocks and domestic production in this sector.

A handwritten signature in black ink, appearing to read "Jesse Norman". The signature is fluid and cursive, with a long, sweeping underline that extends to the right.

Executive summary

What we consulted on

- 1 Domestic transport is now the UK's largest emitting sector of damaging greenhouse gas emissions, accounting for nearly a quarter of emissions. Transport emissions increased in both 2014 and 2015. As demand for travel continues to grow, we need to decarbonise transport more rapidly to meet our future carbon budgets.
- 2 Increasing vehicle efficiency, including the promotion of ultra-low emission vehicles, is a key part of Government strategy to reduce carbon emissions. We announced in 2011 our intention that conventional car and van sales would end by 2040, and for almost every car and van on the road to be a zero emission vehicle by 2050. We have committed to investing over £2.7 billion overall in air quality and cleaner transport. This includes £1 billion in the development, manufacture and use of ultra-low emission vehicles (ULEVs).
- 3 In the meanwhile, liquid fuels will continue to be required, and even in the longer term, areas such as aviation and heavy goods will continue to be reliant on liquid fuels.
- 4 To ensure that the UK benefits from the industrial opportunities available from the decarbonisation of transport, and fulfils our climate change commitments, a long-term, joined-up strategy is required to lower the greenhouse gas intensity of transport fuels, to provide a stable, sustainable policy environment to support investment in renewable low carbon fuel production and supply.
- 5 We consulted on a range of measures to amend our existing Renewable Transport Fuel Obligation (RTFO) to support our strategy. The consultation period began on 29 November 2016 and ran until 22 January 2017.

What we proposed

- 6 The consultation contained proposals aimed at increasing both the supply of sustainable renewable fuels and their use in sectors that are hard to decarbonise, such as aviation and heavy good vehicles.
- 7 We proposed to increase targets for the supply of renewable fuels to 2020, and maintain that level until 2030, to provide long term policy stability to industry. In addition, we proposed increasing the supply of waste derived fuels and encouraging the production of advanced, or 'development', fuels, and renewable fuels of non-biological origin such as renewable hydrogen.
- 8 Recognising the risks from indirect land use change we sought views on an appropriate and sustainable level for the use of crop derived fuels.
- 9 We also sought views on operational changes to simplify the operation of the RTFO and reduce burdens on suppliers.

Stakeholder views and Government response

- 10 The majority of responses from stakeholders focussed on the questions regarding the level of the Obligation in 2020 and 2030, and the level of the crop cap. Our response to the main issues can be found below. A detailed summary of the responses to each question are set out in full in this document.
- 11 In addition to 126 individual responses to the consultation, we received 480 responses as part of campaigns organised by a number of UK based bioethanol suppliers. These responses addressed questions 1, 6 and 13 of the consultation. Key messages from the campaigns were; support for proposals to increase the RTFO obligation level to 9.75% in 2020, concern at the lack of ambition shown in the proposed obligation level from 2020-2030, and support for setting the limit on the level of crop derived biofuel that may count towards the obligation at no less than 7%. The campaign responses came from a mix of those employed in the bioethanol industry, suppliers and partners of these companies, in particular those based in UK agriculture, local authorities and concerned private individuals. These responses are additional to those noted on page 23 and are summarised in the relevant sections of this Government response.
- 12 We would like to thank all stakeholders for their time taken in responding to the consultations. We have carefully considered them and the evidence provided in developing the Government response and final amendments to the RTFO.

Level of the obligation

- 13 We will increase the obligation level to 9.75% in 2020 as set out in the consultation. To address issues around market certainty and consistency with our carbon budgets, we will continue to increase the level beyond 2020 and extend the period of the target trajectory such that the RTFO level will reach 12.4% in 2032. Increases above 9.75% after 2020 will be to the development fuels sub-target.

Approach to wastes and double rewarding

- 14 We will implement our consultation proposal to ensure that wastes eligible for additional reward are those that would not otherwise be used for higher value applications. However, in response to stakeholder concerns about precisely how the waste hierarchy concept is incorporated into the RTFO legislation, we will:
- Ensure that references to the waste hierarchy in the revised Order provide the full flexibility included in the Waste Framework Directive; and
 - Consult with industry in developing guidance and procedures to manage any changes resulting from the revised legislation.
- 15 We are also working closely with other government departments to ensure consistent policy on wastes and to identify areas where Government can help make the collection and utilisation of waste streams easier for business.

The development fuels sub-target: level and qualifying fuels

- 16 We will proceed with our proposal to introduce a sub-target for development fuels. In

response to the consultation we have, however, made some changes to improve its effectiveness in supporting investment in UK infrastructure for fuels required to decarbonise the most challenging transport sectors. We have:

- Set the level of the sub-target at 0.1% in 2019 rising to 2.8% in 2032;
 - Extended the period of the target to 2032, aligning it with domestic carbon budget periods; and
 - Placed a greater focus on the types of qualifying fuels to ensure the target is sufficiently challenging to support investment.
- 17 Having considered the points raised by stakeholders we can confirm that the following renewable fuels will be eligible for development fuel RTFCs, where they are made from an eligible feedstock:
- Aviation fuel;
 - Substitute natural gas;
 - Hydrogen; and
 - Fuels that can be blended at rates of at least 25% whilst meeting either fuel standard EN590 or EN228.
- 18 The level of the buy-out will be set at 80 pence per certificate. As development fuels receive two development RTFCs, the level of support is up to £1.60 per litre.

Setting maximum levels for the use of crops

- 19 We will introduce a sliding scale for the maximum contribution from fuels made from agricultural crops used to meet the obligation. The level is intended to provide a market for domestic producers to utilise installed capacity, to ensure that E10 fuel could be deployed as a cost effective means to meet supplier obligations, and to provide a clear pathway towards higher contributions from waste derived fuels.
- 20 The maximum level will begin at 4% in 2018 and reduce linearly year on year from 2021 to reach 3% in 2026 and 2% in 2032.

Including renewable aviation fuels and non-biological renewable fuels in the RTFO

- 21 The Government will make sustainable renewable aviation fuels and renewable fuels of non-biological origin eligible for reward under the RTFO when the changes are implemented.

Parallel consultation on proposed amendments to the Motor Fuel Greenhouse Gas Regulations

- 22 In a parallel consultation, we set out proposals to amend the UK Motor Fuel Greenhouse Gas Regulations 2012 to reduce greenhouse gas emissions from transport fuel by 6% by 2020, and to increase the transparency of the origin of transport fuels used in the UK. These proposals will implement Article 7a of the Fuel Quality Directive (FQD).

Implications of leaving the EU

- 23 On 29 March 2017 the Government invoked Article 50 of the Treaty of the European Union, starting the negotiations to leave the EU. Until these negotiations are concluded, the UK remains a full member of the European Union and all the rights and obligations of EU membership remain in force. During this period the Government will continue to negotiate, implement and apply EU legislation.
- 24 Whilst the policy proposals outlined in this consultation will fulfil current EU requirements, the underlying policy driver – climate change – is relevant to the UK at domestic, EU and international level. The measures outlined will not just help transport meet its share of the carbon budget reductions – they also offer UK industry the long term certainty it needs to invest and be in a position to take advantage of the growing global advanced fuels market. Leaving the EU is therefore not expected to have a material effect on the direction of the policy outlined in this consultation and Government response.
- 25 Looking ahead, the decision to leave the EU means we have the opportunity to look afresh at how we can act to further reduce the climate change impact of the transport fuels we use in the UK. We have designed the approach outlined here following comments from this consultation to meet the needs of our country. We want a smart, efficient approach focused on delivering the outcomes we all want, to support low carbon transport and a strong economy.

Geographical coverage

- 26 The proposed amendments to the Renewable Transport Fuel Obligations Order 2007 apply across the whole of the United Kingdom.

List of consultation policy questions

Chapter 1: Renewable fuel supply trajectory to 2030

- Question 1 – Do you agree with setting the RTFO overall obligation level at 9.75% for 2020 and maintaining at least that level until 2030?

Approach to wastes and double rewarding

- Question 2 – Do you think there will be any unintended consequences of including the waste hierarchy concept in the RTFO Order?
- Question 3 – Do you agree with the rationale to support particular fuels that meet the UK's long-term strategic objectives?
- Question 4 – Do you agree with the feedstocks that are eligible for the sub-target?
- Question 5 – Do you consider that certain energy crops - namely ligno-cellulosic material and non-food cellulosic material except saw logs and veneer logs - should be excluded from the sub-target?
- Question 6 – Do you agree with the proposed levels for the sub-target?
- Question 7 – Do you think that biomethane should be included in the development fuel sub-target?
- Question 8 – Do you agree that each of the other specified fuels (hydrogen, aviation fuel, HVO, biobutanol and fuel that can be blended with petrol or diesel above current limits) should be included?
- Question 9 – For those development fuels that can be blended with standard fuels, at what level should the minimum blend capability requirement be set, whilst still meeting the relevant fuel standard?
a) 15% b) 20% c) 30% d) Other
- Question 10 – Are there ways in which we can increase the supply of advanced biofuels in a cost-neutral way?
- Question 11 – Do you agree that for novel fuels it is appropriate for the Administrator to require independent assurance of the volume of fuel when necessary?
- Question 12 – Do you agree that for novel fuels the RTFO Administrator should have the discretion to require a 'reasonable' level of assurance rather than a 'limited' level?

Setting a level for the supply of crop based biofuels

- Question 13 – For both 2020 and 2030 at what level should the supply of crop derived fuels be set?
a) 0% b) 2% c) 7% d) another percentage

- Question 14 – Do you anticipate any unintended consequences as a result of basing the definition of crop and starch rich crops on that provided by the ILUC Directive?
- Question 15 – Do you agree with the labelling of RTFCs for crop derived fuels as ‘crop’ and the proposal to limit the number of ‘crop’ RTFCs that can be redeemed in a single year?

Chapter 2: Eligible fuels

Aviation fuels

- Question 16 – Do you agree that both renewable avtur and renewable avgas should be eligible for reward under the RTFO?
- Question 17 – Do you agree that the blending/certification point is a suitable control point for renewable avtur used for both commercial and private pleasure use?
- Question 18 – Is there an alternative control point which we should consider?
- Question 19 – Do you agree that the duty point is a suitable control point for renewable avgas?
- Question 20 – Do you agree that for renewable avtur, it is appropriate for the Administrator to require independent assurance of the volume of fuel when necessary?
- Question 21 – Do you agree that the requirement for a reasonable level of assurance, rather than the lower limited level of assurance, is appropriate for renewable avtur?

Inclusion of non-biological renewable fuels, including hydrogen

- Question 22 – Do you agree with applying the definition of non-biological renewable fuels used in the amended RED? If not, please provide an alternative and set out why.
- Question 23 – How might low carbon fossil fuels be supported beyond 2020, which fuels, feedstocks and/or technologies should be encouraged, and is the RTFO the right mechanism?
- Question 24 – Do you agree with the proposed approach for determining how much of the fuel is a renewable fuel of non-biological origin?
- Question 25 – Do you agree that renewable fuels of non-biological origin should meet the same sustainability criteria (apart from the land criteria) as biofuels?
- Question 26 – Do you agree that the GHG calculation methodology should align with the RED, where possible, for consistency with biofuels?
- Question 27 – Do you have any other comments on the GHG calculation methodology?
- Question 28 – Do you agree with the proposed level of reward for renewable hydrogen – 4.58 RTFCs per kg?
- Question 29 – Do you agree that the point at which renewable hydrogen is sold to a retail customer for use in a fuel cell vehicle is an appropriate ‘control point’ for this fuel?

- Question 30 – Do you agree that the proposed powers for the Administrator are sufficient to ensure the independent verification of the amounts of fuels which are not subject to duty of excise?
- Question 31 – Do you agree that the requirement for a reasonable level of assurance, rather than the lower limited level of assurance, is appropriate?

Preventing double reward for the same energy

- Question 32 – Do you agree with the proposal to prevent the claiming of RTFCs for fuels created by a precursor that has been rewarded under another renewable energy scheme?
- Question 33 – Do you have any opinion as to whether either of the two options considered would be preferable and whether either would have unintended consequences?

Chapter 4: Operational changes

Calendar year reporting and changes to deadlines

- Question 34 – Do you think there will be any negative consequences as a result of changing the RTFO obligation period to a calendar year?

Carry over of RTFCs in 2020

- Question 35 – Do you agree with the proposal in option 4 to prohibit the carry-over of RTFCs into 2020, and also allow RTFCs from 2019 to be carried over into 2021?
- Question 36 – Do you prefer any of the other options in Table 9, or have alternative suggestions?

Review clause

- Question 37 – Do you agree that the specific duty to review the obligation level to ensure we meet the RED 2020 targets for transport is no longer required and should be removed?

Chapter 6: Further potential for low carbon transport fuels

- Question 38 – When we leave the EU, what further opportunities should we consider to develop our low carbon transport fuels policy framework and related policies? Please explain why.
- Question 39 – What is the potential in the UK for the use of biofuels (waste derived biomethane and biodiesel etc) as fuel for HGVs?
- Question 40 – What are the key barriers to wider deployment of biofuels in the HGV sector?
- Question 41 – What should be the role of Government / industry in addressing these barriers?
- Question 42 – Do road freight operators and freight fuel suppliers welcome initiatives to promote the use of biofuels into freight?
- Question 43 – Will the fuel industry deploy biofuels directly into road freight in the period to 2020 at the obligation level set out in this consultation (9.75% in 2020)?

- Question 44 – How can the Government cost effectively promote biofuels in the road freight sector?

Glossary

Administrator	The Secretary of State is the Administrator of the scheme. (This function of the Secretary of State is exercised through the RTFO Unit in the Department for Transport).
Avgas	Aviation fuel used in aircraft powered by piston engines.
Avtur	Aviation fuel used in aircraft powered by gas turbine engines.
Biofuel	A liquid or gaseous fuel used in transport that is produced wholly from biomass. ¹
Biodiversity	Measurement of the variety of different life forms in a given area. High biodiversity is viewed as an indication of a healthy ecosystem.
Bioeconomy	Applying the results of scientific research into biological processes to improve industrial process and create economic opportunities, growth and jobs.
Bioenergy	A term that covers all energy produced from biomass: most common uses are transport, heat and electricity.
Blend wall	The level of biofuel that can be blended into fossil fuel without changes needed to infrastructure, supply and/or vehicles. Fuel standards, such as BS EN590 which allows up to 7% biodiesel in diesel (known as B7), and BS EN228 which allows up to 10% ethanol (known as E10), are agreed and led by industry who take into account the compatibility of vehicles. In the UK petrol supplied typically contains no more than 5% ethanol (known as E5). Some drop in fuels, such as hydrotreated vegetable oil (HVO), can be blended at much higher levels with little or no impact on vehicle compatibility
BSI	The British Standards Institution is the national standards body of the UK.

¹ Defined in the Energy Act 2004

Buy-out fund	Under the RTFO obligated suppliers must demonstrate that they have met their obligation by redeeming Renewable Transport Fuel Certificates or through 'buying-out' of their obligation at a rate of 30 pence per litre of biofuel not supplied.
Carbon budget	<p>Introduced as part of the Climate Change Act 2008 to help the UK reduce greenhouse gas emissions by at least 80% by 2050.</p> <p>Covering periods of five years, a carbon budget places a restriction on the total amount of greenhouse gases the UK can emit.</p> <p>Under the system every tonne of greenhouse gases emitted between now and 2050 will count. Where emissions rise in one sector, the UK will have to achieve corresponding falls in another.</p>
Carbon capture and utilisation	A term covering a range of technologies that capture waste carbon, usually in the form of carbon dioxide (CO ₂), and convert it into commercial products, including fuels.
Carbon defaults	Default carbon intensity (or greenhouse gas emission) values expressed in grams of CO ₂ per megajoule of fuel used.
Carbon stock	Measurement of the carbon stored in the vegetation and soil of a given area of land. The carbon stock can go up or down depending on the use of that land. Forests and peatland are examples of land with high carbon stocks.
Carry over	The current RTFO Order allows an obligated supplier to meet 25% of its obligation in any given period with RTFCs issued in the preceding period and carried over to the period in question, this is known as carry over.
CEN	<p>The European Committee for Standardisation, it brings together the national standardisation bodies of 34 European countries.</p> <p>Officially recognised by the EU and the European Free Trade Association as responsible for developing and defining voluntary standards at European level.</p>
Commission	European Commission. Institution of the European Union which drafts proposals for new European laws, manages the day-to-day business of implementing EU policies and spending EU funds.

Consolidated Fund	The Consolidated Fund is the Government's general bank account at the Bank of England. Payments from this account must be authorised in advance by the House of Commons.
Defaults	Shorthand for default carbon values (see carbon defaults above).
Development fuels	Advanced renewable fuels made from wastes that are eligible for double reward (apart from segregated oils and fats such as UCO and tallow). Eligible renewable fuels are hydrogen, substitute natural gas, aviation fuels and fuels that can be blended above a certain limit whilst still meeting standards for petrol and diesel.
Double reward	The Renewable Transport Fuel Obligations (RTFO) Order (the Order) was amended in 2011 to provide double reward for biofuels made from certain wastes, residues, non-food cellulosic material and ligno-cellulosic material. Where these meet sustainability criteria they are eligible for twice the number of Renewable Transport Fuel Certificates (RTFCs) than biofuels from crops or other non-waste feedstocks. In determining which renewable transport fuels should be eligible for double rewards under support schemes member states must consider compatibility with criteria in the Waste Framework Directive and the objectives of the Renewable Energy Directive.
Economic operator	Any company or organisation involved in the fuel supply chain.
Energy crop	Crops which consist of non-food cellulosic material or ligno-cellulosic material, except saw logs and veneer logs; which are grown for the purpose of being used as fuel or energy; which are not a residue or a waste; and which cannot be used for food or feed.
FAME	Fatty-acid-methyl-ester is made through the chemical reactions of vegetable or animal fats being processed with alcohols, typically methanol. A mixture of fatty-acid-methyl-esters, or 'FAME', is commonly referred to as biodiesel.
Feedstock	Raw material used to produce transport fuels including biofuels.
Fossil fuel	Fuels which have been formed from the organic remains of prehistoric plants and animals.

Fuel cell	Fuel cells use a chemical process to convert hydrogen rich fuel into electricity to power a vehicle.
FQD	Directive 98/70/EC (as amended) known as the Fuel Quality Directive. Requires suppliers to reduce the lifecycle greenhouse gas (GHG) intensity of transport fuels and includes sustainability criteria for biofuels.
GHG	Greenhouse gas – a gas which in the atmosphere absorbs and emits radiation causing the ‘greenhouse effect’ whereby heat is trapped in the atmosphere making the earth warmer and leading to climate change. For example carbon dioxide (CO ₂) nitrous oxide (NO), methane, water vapour, hydrofluorocarbons, perfluorocarbons and sulphur hexafluoride.
GHG Reporting Regulations	The Motor Fuel (Road Vehicle and Mobile Machinery) Greenhouse Gas Emissions Reporting Regulations 2012. Currently provides a UK scheme for reporting the greenhouse gas intensity of liquid and gaseous fuels used in road vehicles and mobile machinery.
HVO	Hydrotreated vegetable oil – a renewable diesel that can be produced from a wide array of vegetable oils and fats which are thermochemically treated with hydrogen.
Installation	A processing plant used to make a material modification from any relevant feedstock to the finished fuel. It does not include installations solely used for the collection, transportation or storage of the feedstocks (as defined in the schedule to the Renewable Transport Fuel Obligations Order).
Indirect land-use change - ILUC	Land-use change where the cause is at least a step removed from the effects – the knock-on effects on expansion of agricultural land use resulting from the cultivation of biofuel feedstocks.
ILUC Directive	Directive 2015/1513, known as the ILUC Directive, which amends the RED and the FQD in order to take account of the effect of indirect land-use change, and aims to encourage the transition away from first generation biofuels.
ISO	International Organisation for Standardisation.
ISAE	International Standard on Assurance Engagements.
Mandatory sustainability criteria	Criteria specified in the Renewable Energy and Fuel Quality Directives – requiring that biofuels, with some exceptions, must deliver greenhouse gas savings of

at least 35% when compared to fossil fuels and that biofuels must not be sourced from areas of high biodiversity, or from high carbon soils (e.g. rainforests or wetlands). All biofuels must meet these mandatory sustainability criteria in order to be counted towards meeting the targets in the Directives.

Minimum threshold	The RTFO Order places an obligation on entities that supply a volume of road transport and NRMM fuel above a minimum threshold. The minimum threshold is set at 450,000 litres.
NGO	Non-Government Organisation.
Non-biodegradable feedstocks	Waste that cannot be broken down by other living organisms.
NRMM	Non-road mobile machinery. NRMM is used to collectively refer to the end uses of fuel specified in the Fuel Quality Directive, namely: non-road mobile machinery (including inland waterway vessels when not at sea); agricultural and forestry tractors; and recreational craft when not at sea.
Obligated supplier	A transport fuel supplier upon whom a renewable transport fuel obligation is imposed.
Non-obligated supplier	A supplier of fuel below the minimum threshold of 450,000 litres per annum. Non-obligated suppliers may open RTF accounts and apply for RTF certificates.
Partially-renewable fuel	Fuels that are produced in part from renewable feedstocks and in part from mineral/fossil feedstocks.
RED	Renewable Energy Directive 2009/28/EC. Requires Member States to ensure that 10% of the energy used in transport is from renewable sources in 2020.
Renewable fuel	A fuel used from a source that is either inexhaustible or can be indefinitely replenished at the rate at which it is used. Such as a biofuel or other fuels produced from a renewable energy source i.e. renewable fuels of non-biological origin.
Renewable fuel of non-biological origin (RFNBO)	A renewable transport fuel that does not have any biological content – rather the renewable energy content comes from renewable energy sources other than biomass. For example, renewable methanol produced from waste CO ₂ and hydrogen where the process is powered by geothermal electricity.

Renewables Obligation	<p>The Renewables Obligation (RO) is one of the main support mechanisms for large-scale renewable electricity projects in the UK.</p> <p>It places an obligation on UK electricity suppliers to source an increasing proportion of the electricity they supply from renewable sources.</p> <p>The RO closed to new generating capacity on 31 March 2017.</p>
Renewables Obligation Certificates	Certificates issued to operators of accredited renewable generating stations for the eligible renewable electricity they generate.
ROS	Renewable Transport Fuel Obligations operating system. The IT system used to administer the RTFO.
RTFC	Renewable Transport Fuel Certificate. One RTFC is awarded for every litre of liquid biofuel reported. Biomethane receives 1.9 RTFCs per kg and bio-LPG receives 1.75 RTFCs per kg. Biofuels from wastes receive double the number of RTFCs. They can be traded between suppliers. Their value is determined by the market.
RTFO	Renewable Transport Fuel Obligations. Introduced in 2008, it is the UK's main mechanism for supporting the supply of renewable fuels in transport. It places an obligation on suppliers of more than 450,000 litres per year of fuel intended for road transport and NRMM use to ensure a certain percentage of the fuel supplied is renewable, and operates as a certificate trading scheme.
RTFO Order	The Renewable Transport Fuel Obligations Order 2007, as amended. The legislation establishing the RTFO scheme.
Substitute, or synthetic, natural gas (SNG)	A gas produced from fossil fuels, biofuels (i.e. bio-SNG) or from renewable electrical energy (i.e. renewable-SNG).
Verification	The process of providing assurance of biofuel sustainability data or other fuel related data (e.g. place of purchase, volume produced) supplied on behalf of reporting parties. Verifiers must be independent of the reporting party whose data they are verifying.
Voluntary scheme	Schemes run by independent organisations that offer a route to providing assurance that biofuels meet certain sustainability criteria.

Waste hierarchy	Defined in EU Directive 2008/98/EC. A waste management strategy that prioritises the prevention, re-use, recycling and recovery of waste products over disposal.
Waste Framework Directive	EU Directive 2008/98/EC. Sets the basic concepts and definitions related to waste and lays down some basic waste management principles, including the waste hierarchy.

Responses received

In addition to 480 campaign responses on proposals for the future RTFO obligation level and limits on the amount of crop derived biofuel that may count towards the obligation, a range of organisations responded to questions concerning the Government's proposals:

Type of organisation	Number of respondent
Academic	2
Aviation sector	3
Consultancy	3
Electricity supplier	1
Energy sector	1
Farmer	27
Fossil fuel supplier	8
Gas fossil fuel supplier	3
Fuel storage	1
Hydrogen supplier	2
Independent advisory body	1
Individuals	4
Industry representative body	19
Investment group	1
Local Authority	3
Non-governmental organisation (NGOs)	6
Non-Departmental Public Body	1
Renewable fuel producers/supplier	35
Renewable gas fuel supplier	1
Road freight sector	1
Waste recycling company	3

1. Renewable fuel supply trajectory to 2030

Overview of consultation

- 1.1 Chapter 1 of the consultation contained proposals to meet the 2020 target required by the Renewable Energy Directive (RED) and to provide long term policy stability to industry and investors with targets set out to 2030. In addition it set out proposals designed to ensure that these targets were met in the most sustainable way possible by:
- Incentivising the production of renewable fuels from wastes and discouraging the use of wastes which can be employed for more productive uses;
 - Creating a sub-target to incentivise advanced fuels of strategic importance to the UK; and
 - Setting a sustainable level for the use of crop based biofuels.

Trajectory to 2020 and beyond

Consultation proposal

- 1.2 The consultation proposed to increase the RTFO target from 4.75% currently in equal steps to 9.75% by 2020, and to maintain at least 9.75% in the period to 2030. Targets between 2020 and 2030 would be kept under review as part of the Government's process to meet its commitments to reduce carbon emissions, including commitments under the UK Climate Change Act.

Question 1 – Do you agree with setting the RTFO overall obligation level at 9.75% for 2020 and maintaining at least that level until 2030?

Summary of responses

Total	Yes	No	Other
565 (480 campaign)	543 (480 campaign)	19	3

- 1.3 There were 82 individual responses to this question. In addition there were 480 campaign responses considering this question:
- 1.4 Many respondents distinguished between the target for 2020, and that for 2030. In doing so they supported increases proposed to increase the obligation level to 9.75% by 2020 but qualified this by explaining that they did not support maintaining a 9.75%

obligation to 2030. They argued that post 2020 the obligation must increase further to meet our carbon emissions reduction targets. A large number also commented on the trajectory of the target in the period to 2020.

2020 target

- 1.5 Not including campaign responses sixty-three respondents agreed with the 2020 target including most respondents from the oil, agriculture and renewables sectors, academia, associations and consultancies. Two NGOs agreed with the target providing that crop derived fuels were phased out or limited to crops certified as low indirect land use change (ILUC) through schemes such as the Roundtable for Sustainable Biofuels.
- 1.6 Ten respondents disagreed with the 2020 target. Three respondents from the non-governmental organisation (NGO) sector were concerned about any increase in the use of biofuels and disagreed with the structure of the RTFO which is based on volume rather than greenhouse gas savings. Two respondents from the fossil fuel supply sector raised concerns about mixing fossil with bio components in the supply chain.
- 1.7 Five respondents from the renewables and farming sectors considered that the 2020 target was too low and should be 10% by energy in real terms (rather than the 5-6% by energy the RTFO is expected to deliver).

Trajectory to 2020

- 1.8 Twenty-six respondents also commented on the proposed trajectory to 2020.
- 1.9 Twenty respondents from the renewables sector wished to see a steep increase from the current 4.75% RTFO target, depending on when revised legislation came into effect. Some suggested raising the target to a minimum of 7.25% if the revised RTFO were to be introduced in September 2017, or to raise to 7.5% should it be introduced in April 2018. Ten respondents recommended an increase to 8.5% from April 2018.
- 1.10 Five respondents from the fossil fuel supply sector considered that the increase in targets should be no more than linear. One respondent from the fossil fuel supply sector explicitly agreed with the proposed trajectory.

2030 target

- 1.11 Most respondents welcomed the setting of targets beyond 2020 to provide longer term investment certainty, but the majority of respondents disagreed with the level of target proposed for 2030.
- 1.12 Ten respondents comprising three NGOs and seven from the fossil fuel sector did not wish to see targets set after 2020. Those respondents from the fossil fuel sector considered that the UK should await EU decisions on 2030 targets. One of these suggested that the decision for the UK to leave the EU provided an opportunity to mitigate carbon emissions more cost effectively, for example through market wide carbon trading.
- 1.13 Eighteen respondents, comprising all stakeholder groups, agreed with the level of the 2030 target. Of these, two NGOs agreed with the target providing that crop derived fuels were phased out or limited to crops certified as low ILUC.

- 1.14 Forty-five respondents, primarily comprising the renewables sector, considered that maintaining the level of obligation at 9.75% as a minimum to 2030 lacked ambition and should increase between 2020 and 2030.
- 1.15 Many of these respondents noted that liquid fuel use is forecast to decline significantly to 2030 under UK carbon budget scenarios, and thus biofuel volumes would also effectively decline if the RTFO obligation was held static over the period.
- 1.16 These respondents noted that meeting the UK's fifth carbon budget scenario as set out by the Climate Change Committee would require an increasing obligation over the period. Respondents including potential investors in advanced biofuels stated that companies would not be inclined to build, and invest in the UK if demand were not seen to be growing. Many respondents suggested that the RTFO levels should be increased each year to avoid a decline in absolute volumes, and further raise the obligation 0.25% per annum over the period.

Period beyond 2030

- 1.17 One respondent noted that 2030 was only just over a decade away, and that a longer period of certainty was required for investment purposes.

Other

- 1.18 One respondent called for more electric vehicles, and another that targets should be set in excess of what can be delivered to create ongoing demand.

Government response

- 1.19 The Government welcomes the support expressed for increasing the RTFO and will set the 2020 Obligation level at 9.75%.
- 1.20 The Government has noted the views of stakeholders on longer term targets, particularly regarding the conditions necessary for investment.
- 1.21 To help ensure the policy is best placed to meet our objectives we will therefore set an increasing trajectory for the Obligation level, and extend the period for the targets, so the Obligation will reach 12.4% in 2032. This is intended to:
 - Provide industry and investors with long term stability and a growing market;
 - Further support delivery of the savings required by UK carbon budgets; and
 - Align the time horizon of the RTFO with the carbon budget process (the fifth carbon budget concludes in 2032).
- 1.22 The trajectory for the full period is set out in Table 1 below, alongside the pre-consultation proposals for comparison.

Table 1 RTFO Obligation trajectory to 2032

Obligation period	PRE CONSULTATION Target (obligation) level, as share of total liquid fuel by volume, may include double rewarding	POST CONSULTATION Target (obligation) level, as share of total liquid fuel by volume, may include double rewarding
15.4.2017-14.4.2018 (RTFO Year 10)	6.0%	
15.4.2018-31.12.2018 (RTFO Year 11)	7.25%	7.25%
2019 (RTFO Year 12)	8.50%	8.50%
2020 (RTFO Year 13)	9.75%	9.75%
2021 (RTFO Year 14)	9.75%	10.1%
2022 (RTFO Year 15)	9.75%	10.4%
2023 (RTFO Year 16)	9.75%	10.6%
2024 (RTFO Year 17)	9.75%	10.8%
2025 (RTFO Year 18)	9.75%	11.0%
2026 (RTFO Year 19)	9.75%	11.2%
2027 (RTFO Year 20)	9.75%	11.4%
2028 (RTFO Year 21)	9.75%	11.6%
2029 (RTFO Year 22)	9.75%	11.8%
2030 (RTFO Year 23)	9.75%	12.0%
2031 (RTFO Year 24)	9.75%	12.2%
2032 (RTFO Year 25)	9.75%	12.4%

Approach to wastes and double rewarding

Consultation proposal

1.23 The consultation proposed to ensure that wastes eligible for additional reward are genuine wastes that would not otherwise be used for higher value applications. The consultation proposed to do this by incorporating the waste hierarchy concept into the Renewable Transport Fuel Obligations Order, introducing a two stage process whereby:

- Waste would be defined in line with the Waste Framework Directive (WFD) definition of waste. Materials that are wastes for the purposes of the WFD will not have to meet the land based sustainability criteria; and
- Wastes would also be assessed as to whether they meet the requirements of the waste hierarchy for use as a fuel. Only these wastes would be double counted.

Question 2 – Do you think there will be any unintended consequences of including the waste hierarchy concept in the RTFO Order?

Summary of responses

Total	Yes	No	Other
72	43	17	12

- 1.24 Over half of the respondents, comprising stakeholders from the renewable and fossil fuel sectors (including industry representative bodies for both) and an NGO, considered that there would be unintended consequences.
- 1.25 The most frequently cited consequence was that a substance or material currently considered to be a waste may no longer have that status. This point was raised by 24 respondents, predominantly fuel suppliers and waste handling companies in the renewables sector, and included industry representative bodies. Used cooking oil, where it is permitted as animal feed, was provided as an example by the majority.
- 1.26 Those respondents involved in the supply of biodiesel suggested that a strict implementation of the waste hierarchy could create uncertainty as to which feedstocks qualified for double Renewable Transport Fuel Certificates (RTFC), undermine investor confidence, increase costs and cause job losses. They therefore suggested that we do not rely on the laws in the country of a feedstock's origin when determining whether a material had an alternative use, but should consider this under UK law.
- 1.27 Due to these concerns, they did not agree with the inclusion of the waste hierarchy in the RTFO Order. The majority did however state that introducing it into guidance would be more appropriate as it would allow the Administrator flexibility to ensure it did not undermine wider policy intent. They argued that this approach would be more in line with the RED as it only refers to having 'due regard' for the waste hierarchy.
- 1.28 Another consequence of our proposal was that it might limit the amount of feedstocks that double count. Respondents were concerned that this was not the intention of the RED or ILUC Directive, and that it could restrict how suppliers meet their targets, forcing them to turn to other non-waste feedstocks. These points were raised by fossil fuel suppliers (including an industry representative body), renewable fuel suppliers, one gas supplier and a public body.
- 1.29 Other potential consequences of including the waste hierarchy were:
- It will be difficult to trace GHG emissions past the point of collection for residues; and
 - It may hinder innovation.
- 1.30 Among those who did not think there would be unintended consequences, there was support for our proposal as only genuine wastes would double count, avoiding any potential indirect GHG emissions. This point was raised by the renewables sector, including an industry representative body, an NGO and a respondent from the road freight sector.
- 1.31 Other reasons for including the waste hierarchy were provided by an NGO and one supplier from the renewable and fossil fuel sectors. These were:

- Not including the waste hierarchy will result in adverse impacts on land use, biodiversity and food poverty;
 - The waste hierarchy will ensure resource efficiency. A respondent did however note that the use of waste can still result in sustainability issues; and
 - Introducing the waste hierarchy would increase investor confidence.
- 1.32 Among those that did not provide an explicit answer, eight said they agreed with the principle of including the waste hierarchy concept in the RTFO Order.
- 1.33 Across all respondents, 16 thought that there should be careful consideration as to how the waste hierarchy is applied or that more analysis was needed to determine how it would affect the industry.
- 1.34 Other comments relating to our application of the waste hierarchy were provided by stakeholders from the renewable, fossil fuel, energy, farming and aviation sectors, including one renewable and one aviation industry association, as well as from a consultancy and an NGO. Their comments included:
- We should consult other Government departments to ensure consistent policy;
 - The existing list of wastes should be maintained, and include all feedstocks in RED Annex IX;
 - Feedstocks should not be removed from the waste list without notice;
 - The waste hierarchy should not be the only factor when determining whether a feedstock is a waste or residue, as it would not be feasible to check the status of a feedstock in every single country. Nor should a feedstock's status as a waste or residue change from country to country;
 - It was unclear how the waste hierarchy would be applied to renewable fuels of non-biological origin (RFNBOs);
 - If a waste feedstock is considered to be strategically important then the strict application of the waste hierarchy should be reviewed;
 - Proving that feedstocks meet the waste hierarchy would result in an increased administrative burden for anaerobic digestion plants. This respondent also suggested that we follow DEFRA in recognising anaerobic digestion as environmentally better than composting and other recovery options when food waste is used as a feedstock;
 - Biofuel production should be considered as recycling, and advanced conversion technologies should be distinguished from incineration;
 - Whether we have reviewed the implications for biorefineries; and
 - Concerns over starch slurry, crude glycerine and tallow being considered as wastes.

Government response

- 1.35 We note the support for the principle of ensuring that only genuine wastes, which would not otherwise be used for higher value purposes, are double rewarded under the RTFO. We agree that doing so will reduce the likelihood of indirect GHG emissions and other sustainability issues, ensure resource efficiency and signal to investors the types of biofuels that will receive double reward under the RTFO. A

waste will therefore be eligible for double RTFCs where it would not otherwise be used for higher value end uses according to the waste hierarchy concept.

- 1.36 We do, however, also note the concerns regarding inclusion of the waste hierarchy concept in the legislation and how any changes will be implemented. We will therefore ensure that references to the waste hierarchy in the revised Order provide the full flexibility included in the Waste Framework Directive. The Directive is clear that Member States should encourage the options that deliver the best overall environmental outcome. This may, for example, require specific waste streams to depart from the hierarchy, where this is justified in light of the overall impacts of that waste.
- 1.37 In light of this flexibility, the Administrator may therefore choose to award double RTFCs where that waste might otherwise be used for a higher value end use, but where using that material for biofuel secures a significantly better overall environmental outcome. The extent to which using that material for biofuel delivers a better environmental outcome will determine whether it is eligible for single or double RTFCs. The Administrator will consider such things as lifecycle GHG emissions savings and economic benefits when making that assessment.
- 1.38 We will consult with industry in developing guidance and procedures to manage any changes resulting from the revised legislation. We note that the process should not be overly burdensome but will need to be sufficiently robust.
- 1.39 We will proceed with our proposal to exempt materials that meet the WFD definition of waste from having to comply with the land criteria.
- 1.40 The requirement to meet the land criteria will therefore only apply to feedstocks which are crops, dedicated energy crops and residues from agriculture, aquaculture, fisheries or forestry. Residues from agriculture, aquaculture, fisheries or forestry will always need to meet the land criteria, regardless of whether they are a waste or not.
- 1.41 We are working closely with other Government departments to ensure consistent policy on wastes and to identify areas where Government can help make the collection and utilisation of waste streams easier for business.
- 1.42 In response to the question from a stakeholder regarding how the waste hierarchy will apply to RFBNOs: RFBNOs inputs typically include gases (usually CO₂); however, gaseous effluent emitted into the atmosphere is not within scope of the Waste Framework Directive. It is therefore not possible to apply the waste hierarchy to RFBNO inputs. Nonetheless, it is important that the inputs have not been deliberately produced for the sole purpose of creating a transport fuel so we intend to make this a requirement. All RFBNOs will receive double reward in recognition of their potential environmental benefits and to encourage their deployment. Further information on RFBNOs is provided in chapter 2.
- 1.43 We consider that biofuel production falls within the 'energy recovery' category. As mentioned above, the Waste Framework Directive allows Member States some discretion to depart from it in certain circumstances.

Introduce a sub-target for particular advanced, or ‘development’, fuels derived from specified wastes and residues

Consultation proposal

Setting a target for RED Annex IX part A feedstocks

- 1.44 The RED requires that Member States set a target for a minimum proportion of renewable fuels that are supplied from the materials set out in RED Annex IX Part A which include waste materials, by-products and some energy crops. It includes an indicative target of 0.5% for the share of transport energy from such fuels in 2020, and Member States must justify any deviation from this level.
- 1.45 By energy, the current share of fuels produced from materials included in RED Annex IX Part A in the UK is around 0.3%. The consultation set out our proposal for meeting the indicative target of 0.5% by:
- Double rewarding biofuels made from wastes and residues that would not otherwise be used for higher value end uses;
 - Creating a specific sub-target for specified advanced, or ‘development’, fuels; and
 - Setting a level for the supply of fuels derived from crop feedstocks.
- 1.46 The Government maintains the view that the policies set out to encourage the supply of such fuels should be effective and is, through this Government response, **setting a target of 0.5% for the share of transport energy from those fuels in 2020**. We do not consider it necessary to set this out in legislation.

The development fuels sub-target

- 1.47 Instead of setting a sub-target for RED Annex IX Part A feedstocks, the consultation proposed to incentivise specific advanced, or ‘development’, renewable fuels made from sustainable wastes and residues, or of non-biological origin. This would reward specific fuels that meet the waste hierarchy requirements (except for used cooking oil and tallow), with a new category of RTFC for suppliers to redeem against the sub-target. This is intended to stimulate the production and supply of specific advanced renewable fuels that are suitable for use in transport sectors that are difficult to decarbonise such as aviation and heavy goods vehicles (HGVs).

Question 3 – Do you agree with the rationale to support particular fuels that meet the UK’s long-term strategic objectives?

Summary of responses

Total	Yes	No	Other
73	60	11	2

- 1.48 The vast majority of respondents supported our proposal. These stakeholders were mainly from the renewables sector and included industry representative bodies, but also included four NGOs.

- 1.49 Respondents agreed that it is necessary to support advanced fuels which are of strategic importance to the UK, to help reduce GHG emissions and/or stimulate investment. This point was raised by renewable fuel suppliers, a public sector organisation, a local authority and respondents from the aviation sector (including an industry representative body).
- 1.50 Other reasons for supporting our proposal were provided by a local authority, a renewable fuel supplier and an NGO. Their comments included:
- It would also support biorefineries and waste processing capability;
 - Biofuels should only be used in sectors with limited decarbonisation alternatives; and
 - It will help investors identify which fuels and technologies to support. A stakeholder thought this was important given the nature of the well-established UK fuel industry, which makes it difficult for new fuels and technologies to break through.
- 1.51 Those that did not agree with our proposal were mainly from the fossil fuel sector, and included an industry representative body. Their reasons included:
- The challenge of decarbonising aviation and HGVs is not unique to the UK (this was also mentioned by an independent advisory group);
 - Due to the global nature of those industries, the UK alone would not be able to provide the solution for decarbonisation;
 - There is a lack of clarity over the UK's long term strategic objectives;
 - It is effectively picking winners (e.g. including biobutanol but not bioethanol or biomethanol) which will deter investors from the UK;
 - There would not be enough advanced fuel in 2020 to meet the sub-targets; and
 - It diverges from the RED which does not include a fuel specific sub-target or identify sectors which are difficult to decarbonise. The fossil fuel sector urged consistency between the UK and EU due to the similar vehicle fleet.
- 1.52 Other reasons for disagreeing with our proposals were provided by renewable fuel suppliers plus an industry representative body, and a consultancy. Reasons included:
- Targeting development fuels in their early stages of development is detrimental to existing low-carbon fuels and technologies, some of which are close to commercial deployment; and
 - Development fuels are too expensive, and other options should be considered.
- 1.53 Some respondents, including renewable fuel suppliers (plus an industry representative body), a fossil fuel supplier, a consultancy and two NGOs, also provided some general comments which included:
- There should be a robust methodology which allows fuels to be added or removed from the development list as appropriate;
 - We should ensure, by applying appropriate sustainability criteria, that the focus is on delivering climate and environmental benefits when deciding which fuels to support, taking into account feedstock availability and competing uses;
 - There is a limited supply of wastes and residues meaning that it will take time for new development fuels and technologies to be rolled out;

- The concept will only work if the price of development fuel RTFCs is stable; and
- We should also focus on maritime fuels, reducing the carbon intensity of passenger vehicle fuel beyond 2020 and high blend HGV applications.

1.54 There was also much debate about which fuels should be considered a development fuel. Responses on this subject will be summarised and discussed in later questions.

Government response

1.55 We are pleased that stakeholders agree that our proposal will stimulate investment in the production of low carbon fuels derived from waste, and meet the UK's long-term strategic objectives. We will therefore proceed with our proposal.

1.56 We acknowledge that decarbonising these sectors is not a challenge unique to the UK, and that doing so will require international efforts. However, these sectors are, nonetheless, a significant source of GHG emissions which will need to be tackled in order to meet our climate change objectives in the longer term. Furthermore, the UK strives to be a world leader in climate change policy and this strategy could lead to other countries adopting similar measures.

1.57 In developing the policy on development fuel eligibility we consider it necessary to identify the specific fuels to ensure the policy delivers the desired outcome. To avoid 'picking winners' we have included a 'catch all' option. This is to ensure that fuels which can be blended at certain levels and meet the relevant fuel standards for use in ordinary vehicles can be eligible for the target. We believe this provides a clear signal to investors to focus on fuels the UK will need in the long term. We therefore agree with the stakeholder who noted that such an approach would be required if new fuels and technologies are to succeed.

1.58 We have carefully modelled future fuel supply to ensure that the trajectory of the sub-target, as well as the buy-out price, incentivise investment in development fuels at the right price. The sub-target trajectory and buy-out price are discussed in further detail in questions 6 and 45 (in the cost benefit analysis) respectively.

1.59 Clarification on the other points raised by stakeholders is set out below.

1.60 Development fuels will be subject to the same sustainability criteria as other fuels derived from waste which are double rewarded. This will ensure that they are sustainable and consistent with the development of a circular economy.

1.61 At this point we do not intend to bring maritime fuels into scope of the RTFO. This is because there is not yet international agreement on how the shipping sector should decarbonise and there may be better alternatives to decarbonise shipping. There is a finite resource of biofuel feedstocks and we need to make sure that it is allocated effectively. As with the inclusion of aviation fuel, specific administrative measures would also need to be developed as maritime fuel is not subject to the road fuel duty system which the RTFO system uses to minimise the regulatory burden on industry. We will however keep this under review as the International Maritime Organisation develops its carbon reduction strategy.

1.62 Please refer to our response to questions 7, 8 and 9 for more details on which fuels will be eligible for the sub-target.

Feedstock eligibility for the sub-target

Consultation proposal

1.63 The consultation proposed that a development fuel must be made from a sustainable waste or residue (other than used cooking oil or tallow) which meets the requirements of the waste hierarchy for use as a fuel, or a renewable fuel of non-biological origin.

Question 4 – Do you agree with the feedstocks that are eligible for the sub-target?

Summary of responses

Total	Yes	No	Other
62	37	20	5

1.64 The majority of respondents agreed with our proposal. These mainly included renewable fuel suppliers and their industry representative bodies but also two NGOs.

1.65 Several respondents who agreed did however express some caveats. The most common, as cited by 14 fuel suppliers and waste handling companies in the renewables sector (including industry representative bodies), were that:

- Feedstock eligibility should reflect RED Annex IX Part A (this comment was also raised by seven fossil fuel suppliers and an industry representative body who disagreed with our proposal) and take account of future updates;
- The grandfathering clause in the ILUC Directive should be adopted, so that waste feedstocks which currently qualify as wastes or residues under the RTFO and that are utilised in the market should also qualify; and
- The list of eligible feedstocks should only be added to, and never reduced.

1.66 Other caveats were provided by renewable fuel suppliers (plus an industry representative body), an industry association for the oil processing sector and an NGO. They included:

- Eligible feedstocks must be certified as avoiding or mitigating risks associated with sustainability and indirect effects, which could be achieved using existing methodologies. This respondent, and other NGOs who disagreed with our proposal, also thought that feedstocks should be subject to a full sustainability assessment but that more research would be needed to make such assessments. There was a general concern about the sustainability of the feedstocks listed in RED Annex IX Part A and whether they are all actually wastes;
- Further clarification on the eligibility of straw is needed. Other respondents who did not answer ‘yes’ also requested further clarification on municipal solid wastes, algae, waste industrial gasses, agricultural wastes and the definitions of “non-food cellulosic material” and “ligno-cellulosic material”. It was pointed out that these definitions could make some of the wastes and residues used in anaerobic digestion plants ineligible. It was advised that we refer to Environment Agency guidance;

- The waste hierarchy should be applied to both wastes and residues;
- Demonstrating feedstock eligibility should not be overly burdensome;
- Feedstock eligibility should evolve over time. Another respondent who disagreed said that the process for assessing eligibility using expert groups needs clarifying; and
- Energy crops should be included. This point was also made by four respondents who disagreed with our proposal. Energy crops will be discussed in question 5.

1.67 Nineteen respondents disagreed with our proposal. Reasons for disagreeing not already discussed were provided by renewable fuel suppliers, a consultancy and a fossil fuel supplier. They included:

- To be eligible, a feedstock should also appear in RED Annex IX A to prevent basic fuels, such as Ethyl Tertiary Butyl Ether from waste starch slurry ethanol, from filling the target;
- Proven technologies are being displaced by artificially favoured new technologies;
- It needs to be explicit that renewable electricity and carbon cycle carbon dioxide are eligible, to ensure synthetic natural gas (SNG) can be a development fuel; and
- If sustainable crop residues that meet the waste hierarchy are not eligible, there will not be enough feedstock to make a meaningful contribution to GHG targets, resulting in high costs and a risk of fraud. Two other respondents, who did not disagree, raised similar points. They thought that limiting feedstock eligibility was not necessary and regular reviews of feedstock availability was needed. Two renewable fuel suppliers did however believe there is significant waste availability.

Government response

1.68 We note that the majority of stakeholders agreed that a development fuel must be made from a sustainable waste or residue (other than used cooking oil or tallow) which meets the requirements of the waste hierarchy. We do however intend to modify our approach in light of concerns raised in response to questions 2, 8 and 9.

- We will ensure that references to the waste hierarchy in the revised Order provide the full flexibility included in the Waste Framework Directive. The Directive is clear that Member States should encourage the options that deliver the best overall environmental outcome. Further details are provided in question 2; and
- To ensure that the sub-target does not provide additional support for fuels that are already widely commercially available, we intend to exclude all biofuels produced from segregated oils and fats, not just used cooking oil and tallow. This will ensure the sub-target delivers genuinely advanced fuels that expand the waste resource base, rather than simply utilizing the same wastes that conventional processes are already using.

1.69 Clarification, on why we have not adopted certain measures, and on other points raised by stakeholders in response to this question, are set out below.

1.70 As explained in the consultation, we have concerns about using the feedstocks included in the RED Annex IX Part A as the basis for a sub-target. These concerns, also raised by stakeholders, still remain. We will therefore require that eligible

feedstocks are broadly those that would not otherwise be used for higher value applications

- 1.71 We will not be adopting a grandfathering clause in respect of waste, but we will work with suppliers to ensure that any changes to the list of wastes and residues are managed appropriately, and that industry is consulted.
- 1.72 As is currently the case, the Administrator of the RTFO will assess materials to determine whether they are eligible for double reward. They will also assess whether a feedstock is eligible for the development fuel sub-target. Agricultural residues will be subject to the same assessment – e.g. whether they would otherwise be used for higher value end uses.
- 1.73 We recognise that the definitions of “non-food cellulosic material” and “ligno-cellulosic material” includes both crops and waste and residues. Eligible feedstocks are those wastes and residues which the Administrator has assessed as eligible for double reward (see question 2 for further details), apart from segregated oils and fats. We will ensure that the Order is consistent in this regard.
- 1.74 We will not require feedstocks to be listed in RED Annex IX Part A as an additional eligibility criteria. Our approach to feedstock and fuel eligibility (explained in questions 8 and 9) should ensure that only genuine advanced fuels made from appropriate waste materials are supplied under the sub-target. Following analysis of potential future fuel supply, and taking into account consultation responses, we have set the sub-target trajectory and buy-out price at a level which strikes a balance between stimulating investment to meet our long term carbon reduction needs and additional costs to consumers. We have also responded to stakeholder concerns by increasing the overall level of the obligation in line with the sub-target from 2021, so development fuels will not compete with existing renewable fuels after this date. The sub-target trajectory and buy-out price are discussed in questions 6 and 45 respectively.
- 1.75 We recognise that some feedstocks/fuels will result in better GHG savings than others. Once the ILUC Directive is transposed, the minimum greenhouse gas savings requirement rises to 60% for biofuels produced in installations starting operation after 5 October 2015. This will ensure that renewable fuels continue to increase the contribution they make towards emissions savings. Furthermore, fuels providing higher savings will receive greater reward through the proposed GHG mechanism under which suppliers will be rewarded for the GHG savings their fuels provide against the target level set in the FQD. Please see the parallel consultation on this for further details.
- 1.76 Non-biological renewable fuels will be eligible for the development fuel sub-target, where they are one of the specified fuel types. Furthermore, the inputs must not have been deliberately produced for the sole purpose of creating a RFNBO.

Energy crops – exclusion from the sub-target

Consultation proposal

- 1.77 The consultation explained that we had concerns about including non-food energy crops in the development fuels target given that the ILUC effects of these crops are not yet well understood. Research published by the European Commission does suggest however that certain energy crops could actually have net positive land use

change effects due to an increase in carbon stock on the land. In light of this uncertainty we asked for views on whether to include energy crops in the development fuel target.

Question 5 – Do you consider that certain energy crops – namely ligno-cellulosic material and non-food cellulosic material except saw logs and veneer logs – should be excluded from the sub-target?

Summary of responses

Total	Yes	No	Other
55	18	35	2

- 1.78 The majority of respondents thought that energy crops should not be excluded from the sub-target. These stakeholders were predominantly involved in the supply of renewable or fossil fuel (and included industry representative bodies for both).
- 1.79 The most frequently cited reason for including energy crops was that they are listed in RED Annex IX Part A. It was argued that all feedstocks in Annex IX do not compete with food and save significant GHG emissions compared to fossil fuels. This point was raised by 14 respondents, predominantly fuel suppliers and waste handling companies in the renewables sector (including two industry representative bodies). A similar point was also raised by fossil fuel suppliers in responses to question 4.
- 1.80 Other reasons for including energy crops were provided by renewable fuel suppliers (plus an industry representative body), as well as respondents from fossil fuel, energy and farming sectors, a local authority and a consultancy. They can be grouped as follows:
 - Lignocellulosic bioenergy can reduce GHG emissions by displacing fossil fuels, and cellulosic ethanol offers better GHG savings than regular ethanol. It was thought that energy crops could have low or zero ILUC impacts especially when cultivated on lower-quality or marginal land that is less suitable for food, or on land that lies fallow. Even when grown on cropland, it was thought that ILUC impacts can be mitigated, and that certain energy crops could have net positive land use change effects;
 - Cellulosic ethanol from energy crops could complement existing conventional ethanol production should E10 be introduced, especially if a 2% crop cap is imposed. It was also thought that cellulosic ethanol can be used for other blending applications, such as ED95 in HGVs and as aviation fuel, if modified;
 - Exclusion of energy crops would mean a lower potential supply of development fuel, in the order of millions, or tens of millions, of litres. It was thought that our proposal would exclude what is an abundant source of biomass that can be used to produce a range of fuels, not just cellulosic ethanol. A stakeholder also noted the high conversion efficiencies of cellulosic ethanol and existing supply infrastructure for ethanol;
 - Energy crops support other industries and rural development, by diversifying farmer incomes and delivering other environmental benefits such as increased biodiversity, pollination services, ‘soft’ flood management and protection of water

resources. It was also thought that cellulosic ethanol is important for biorefineries; and

- Inclusion would mean consistency with other support schemes, such as the Renewables Obligation.

- 1.81 Those that agreed with excluding energy crops included all five NGOs that responded, renewable fuel suppliers, an independent representative body for the aviation sector, consultancies and a gas supplier. Their main objection was on the grounds that energy crops do cause ILUC effects and other environmental issues, potentially even more so than food crops as these also provide animal feed.
- 1.82 A range of stakeholders did however consider that energy crops could be allowed in some circumstances, for instance when they were not grown on prime, Grade 1, land or if considered an agricultural residue.
- 1.83 Other respondents thought that to be eligible they must demonstrate carbon savings (taking into account soil carbon losses) compared to fossil fuel and low environmental impacts. For instance, where they were grown on unused land that is unsuitable for food crops, their cultivation did not cause land use change or displacement of other material and their impact on biodiversity, water pollution and soil degradation was low.
- 1.84 An industry representative body who supported their inclusion suggested a low ILUC certification scheme could be made an eligibility requirement as a safeguard.
- 1.85 It was pointed out however, that further data was required to fully understand whether energy crops deliver GHG savings and their impact on competing uses. Furthermore, it was highlighted that all of the energy crops planted in the UK since 2008 were grown on what was arable land (Defra UK crop area statistics), and that there is potentially limited marginal or abandoned land that can be used for energy crops.
- 1.86 One respondent thought that they should be excluded until more data is available but that continuing with double reward in the meantime would be appropriate (so to encourage their use as a means of collecting further data).
- 1.87 Other thoughts on why energy crops should be excluded were provided by renewable fuel suppliers, an independent representative body for the aviation sector, a gas supplier, an NGO and an electricity supplier. Their reasons included:
- Exclusion is needed to ensure investment in advanced technologies;
 - There are other more sustainable feedstocks available;
 - The potential supply and technology challenge does not warrant the incentive; and
 - Saw and veneer logs should also be excluded as they can cause environmental issues and increased emissions when used to produce wood pellets.

Government response

- 1.88 At the current time, we intend to proceed with our proposal to exclude energy crops from the sub target.
- 1.89 Whilst we agree that biofuels produced from energy crops have significant potential to reduce GHG emissions, at present they tend to be grown on arable land and therefore can also cause ILUC in the same way as other agricultural crops.

- 1.90 We understand that it may be possible for ILUC to be avoided or mitigated, for instance through the application of certification schemes or when grown on marginal or abandoned land. However, the development and testing of certification in this area is currently limited. We consider that there is potential in this area and we will keep the development of schemes under review.
- 1.91 In the meanwhile, biofuels made from energy crops continue to be eligible for double RTFCs under the main obligation target.

What level would the sub-target be set at?

Consultation proposal

- 1.92 The consultation proposed sub-targets for each year of the RTFO to 2030, rising from 0.1% in 2017 to 2.4% in 2030. These were to form a growing proportion of the overall RTFO target of 9.75% from 2020.

Question 6 – Do you agree with the proposed levels for the sub-target?

Summary of responses

Total	Yes	No	Other
159(90 campaign)	120 (90 campaign)	34	5

- 1.93 Excluding campaign responses slightly more respondents disagreed with the proposed levels for the sub-target than agreed. These stakeholders comprised renewable and fossil fuel suppliers, including related industry representative bodies, three NGOs and two respondents from the aviation sector (including an industry association).
- 1.94 Where respondents disagreed with our proposal they offered two main reasons: they either thought that a sub-target should not be set at all or that it was not ambitious enough.

Alternative options

- 1.95 Respondents who thought that a sub-target should not be set were mainly from the fossil fuel sector, including an industry representative body, but also one consultancy. Their reasons were:
- A development fuel sub-target is not required by the RED. There is currently no RED target beyond 2020, and we are already likely to meet the sub-target for Annex IX Part A materials in 2020; and
 - Development fuels should instead be supported by a multiple counting approach, in light of a similar mandate in the USA that was unsuccessful.
- 1.96 If a sub-target was introduced they thought that the target should only apply in 2020, as mandated by the RED, and that alternative compliance mechanisms should be in place such as trading, carryover and buy-out, due to uncertainty over fuel availability.

Support for higher sub-targets

- 1.97 Nineteen stakeholders from the renewable and aviation sectors, including industry representative bodies for both, together with a consultancy, said the sub-targets were too low or lacked ambition and would not encourage investment. One respondent who agreed with the sub-targets also said this was true post 2020.
- 1.98 One respondent pointed to research conducted by the Institute for European Environmental Policy to highlight the potential for wastes and residues, which suggested that biofuels from wastes and residues could contribute between 31% and 129% of total UK biofuel demand in 2020; or between 3.1% and 13% to total UK transport energy demand in 2020.
- 1.99 Comparisons were also drawn with the more ambitious sub-targets recently set by Denmark, France and Italy, and the proposed revisions to the RED for the period to 2030. Respondents thought that the sub-target should rise to 3.6% by 2030 (without double counting) and that there should be step changes at certain intervals.
- 1.100 It was also thought that a lack of ambition risked the sub-target being saturated by fuels which are already supplied under the RTFO, such as biomethane and some oxygenates like ethyl tertiary butyl ether. As a result the development fuel target would not attract investment in aviation fuel in particular. It was suggested that we introduce a specific incentive for aviation fuels or those supplied via the most advanced technologies by awarding additional RTFCs to certain feedstock and end uses (such as residual solid wastes and middle distillates), for example by considering aviation fuels as 1.2 times their energy content (as suggested in the revisions to the RED).
- 1.101 The sub-targets should ensure that there is a shortfall of development RTFCs in the market so that they retain their premium. This was also raised by two respondents who supported the proposed sub-targets.
- 1.102 Thirty-four respondents considered that the sub-target should be additional to the main RTFO target.
- 1.103 It was believed that a sub-target which was not additional to the main target would:
- Result in development fuels competing with other renewable transport fuels;
 - Undermine existing investment and production facilities;
 - Potentially increase GHG emissions if waste biofuels with high GHG savings were pushed out by novel fuels which do not achieve the same GHG saving; and
 - Reduce the likelihood of future investment in new fuels and technologies.
- 1.104 Other comments were provided by renewable and fossil fuel suppliers, independent representative bodies for the renewable, fossil fuel, farming and aviation sectors, an independent advisory body, a gas suppliers, an electricity supplier, an NGO and a consultancy. They included:
- There should be scope to review the sub-targets to ensure they remain suitable. For example, if the market for renewable natural gas (biomethane) develops the sub-targets might need raising significantly;
 - More direct funding was needed to help develop new fuels and technologies;
 - There should be a sub-target for electric vehicles;

- The proposed sub-target struck the right balance between encouraging investment whilst keeping consumer costs at a reasonable level;
- The sub-targets should not be legally binding;
- The sub-target would not be met because of RTFC price volatility and the structure of the RTFO, which do not support long term investor certainty;
- We should wait until the revisions to the RED have been confirmed before setting the sub-targets; and
- The sub-target should be consistent with the cost-effective path to the 2050 target as defined by the Committee on Climate Change.

Government response

- 1.105 We welcome the positive response to our proposals and will therefore proceed to introduce the development fuels sub-target.
- 1.106 To address the concerns raised by stakeholders, regarding the potential for the sub-target to attract investment in development fuels, we will make the following changes to our proposals:
- The overall level of the obligation will increase in line with the sub-target from 2021;
 - The sub-target will rise until at least 2032 (rather than 2030);
 - The list of eligible fuels will focus on truly advanced fuels to provide greater investment confidence; and
 - Suppliers will be able to claim development fuel RTFCs in the year before the sub-target comes in to force (2018), such that they can be redeemed against the sub-target in its first year of operation.
- 1.107 The development fuels target profile is set out in table 2.
- 1.108 We are confident that UK industry can rise to the challenge of meeting these sub-targets. By providing a clear long term market signal, alongside investment support such as through our demonstration competitions, the UK has a significant industrial opportunity that could result in export opportunities as well as domestic production and supply. The RTFO 'buy-out' mechanism creates a clear incentive, as well as a further route to compliance with the obligation for any suppliers who choose not to invest or purchase certificates.
- 1.109 Our response to questions 4, 5, 8 and 9 explain how we will ensure the sub-target delivers advanced fuels created from novel feedstocks.
- 1.110 We note that there are significant volumes of conventional waste that can be used to produce biofuel. They will continue to be eligible for double RTFCs where they would not otherwise be used for higher value end uses according to the waste hierarchy concept. Where that is not the case the Administrator has discretion in applying the waste hierarchy to still award double RTFCs where using that material for biofuel secures a significantly better overall environmental outcome, as explained in response to question two.

Table 2 Development fuels sub-target levels 2019-2032

Obligation period	Sub-target (obligation) level, includes double rewarding	Resultant "development" fuel supply as proportion of total fuel supply (by volume)*
2019 (RTFO Year 12)	0.1%	0.05%
2020 (RTFO Year 13)	0.15%	0.075%
2021 (RTFO Year 14)	0.5%	0.25%
2022 (RTFO Year 15)	0.8%	0.4%
2023 (RTFO Year 16)	1%	0.5%
2024 (RTFO Year 17)	1.2%	0.6%
2025 (RTFO Year 18)	1.4%	0.7%
2026 (RTFO Year 19)	1.6%	0.8%
2027 (RTFO Year 20)	1.8%	0.9%
2028 (RTFO Year 21)	2%	1%
2029 (RTFO Year 22)	2.2%	1.1%
2030 (RTFO Year 23)	2.4%	1.2%
2031 (RTFO Year 24)	2.6%	1.3%
2032 (RTFO Year 25)	2.8%	1.4%

* As development fuels will be eligible for double reward, the resultant development fuel supply is calculated as half of the sub-target. However, the actual development fuel supply may be lower where gaseous fuels are supplied under the sub-target (as these will attract more than two RTFCs per kg).

Clarification on the other points raised by stakeholders is provided below.

- 1.111 Trading and carryover of development fuel RTFCs and buy-out will be permitted. The response to question 36 provides further details on how the rules on carry over will apply to development RTFCs.
- 1.112 Developments in technology may mean that further cost effective carbon savings are available and even more stretching targets could be achieved. As with other aspects of the obligation, we will keep the development fuel sub-targets under review as part of the wider carbon budget process. Any changes will be subject to the usual public consultation.
- 1.113 We have provided £20m of direct capital funding through the Advanced Biofuels Demonstration Competition, and a further £22m of funding for advanced fuels for aviation and freight which is being taken forward in the Future Fuels for Flight and Freight Competition (F4C) which was launched in August 2017.
- 1.114 The Government has a wider programme of support for electric vehicles – delivered by the Office for Low Emission Vehicles – including grants for cars, vans, taxis and motorcycles, infrastructure schemes, and consumer outreach. Our proposals to amend the GHG Regulations will also reward electricity used in electric vehicles in 2019 and 2020.
- 1.115 The sub-target will be legally binding to provide investor certainty.

- 1.116 We do not consider it appropriate to wait for the revisions to the EU RED to be confirmed. It may take several years to agree a revised Directive, during which the UK would miss out on opportunities to stimulate the production of development fuels. Acting now provides an opportunity to serve the interests of the UK, and is in line with our domestic priorities. Until the UK leaves the EU, EU law continues to apply alongside national rules.
- 1.117 We believe the wider package of measures we consulted on, including the sub-target, will deliver a cost effective means of increasing the supply of renewable transport fuel and reducing GHG emissions.

Should biomethane be included in the development fuel sub-target?

Consultation proposal

- 1.118 The consultation proposed a ‘Development’ fuels sub-target within the RTFO to provide more support for fuels which meet the UK’s long term energy needs and strategic objectives. A range of fuels were proposed including biomethane. Respondents were asked if they agreed biomethane met the stated objectives.

Question 7 – Do you think that biomethane should be included in the development fuel sub-target?

Summary of responses

Total	Yes	No	Other
62	36	16	10

- 1.119 From a total of 62 respondents, 36 agreed that biomethane should be included in the development fuel sub-target, 16 disagreed, and 10 provided comments or caveats. Respondents were generally in favour of supporting biomethane as a low carbon transport fuel for HGVs, but opinions varied as to whether or not they needed the additional support of the development fuels sub-target.
- 1.120 In favour of supporting biomethane respondents stated that:
- Biomethane is a strategic fuel for the UK;
 - Vehicle efficiency is improving strengthening the case for transport versus heat;
 - Fuel and vehicles are market ready and perform well, other novel fuels are not;
 - HGVs have a short lifespan so the risk of locking into a technology is limited;
 - Availability is higher than identified by the committee on climate change;
 - It will not require expensive infrastructure and the grid has spare capacity;
 - It tackles noise and air quality issues;
 - The HGV sector is difficult to decarbonise with limited options;

- Methane slip is surmountable and specific to dual fuel HGVs;
- Biomethane is not yet established in transport;
- Keep options open;
- Biomethane has a good life cycle analysis score; and
- Biomethane is the best option for HGVs.

1.121 Arguments against supporting biomethane in the sub-target stated:

- It would fill the sub-target diverting funding from advanced fuels and technologies;
- Biomethane is already viable so does not need additional support; and
- There is greater potential availability of biomethane compared to other development fuels therefore that existing incentives are sufficient.

1.122 While two respondents suggested biomethane should be dedicated to heat, three said concerns about the best use of energy for biomass are relevant but not specific to biomethane. They suggested a UK wide assessment of available biogenic resource.

1.123 Several respondents agreed biomethane would not crowd out the development fuel sub-target due to competing demand for its use for heating, limited availability of suitable vehicles and the crop-cap limiting biomethane from anaerobic digestion (though three renewable sector respondents said it should be excluded from the crop cap and one respondent suggested a biomethane sub-target or a cap within the sub-target on specific fuels).

1.124 Several respondents provided more specific suggestions to supporting biomethane including biomethane from waste, grid injected biomethane, synthetic natural gas, biomethanol, the sub-target as additional to the RTFO target, higher support for biomethane from other waste (not food/crops) than standard biomethane and reducing fuel duty to differentiate biomethane from fossil natural gas.

1.125 Two fossil fuel suppliers, whilst against a sub-target, said that if it goes ahead it should include biomethane from RED Annex IX feedstocks.

1.126 A renewable supplier recognised that syngas from biomass feedstocks can be converted to hydrogen, methanol, ethanol, dimethyl ether, methane, biodiesel or kerosene, but highlighted the low cost of producing biomethane from anaerobic digestion.

Government response

1.127 Whilst a majority of respondents were in favour of further supporting biomethane, others expressed concern that allowing such a 'conventional' fuel into the target could undermine investment in more advanced technologies.

1.128 The Government wishes to support the UK biomethane market and will continue to do so via awarding RTFCs to biomethane injected into the grid and through the double counting provisions.

1.129 The Government is keen to ensure that only the most advanced processes are supported through the development fuels sub-target therefore standard biomethane (generated from anaerobic digestion) will not be included under the development fuel sub-target. This will mitigate the risks of shifting supply from heat rather than creating

new investment, of crowding out the sub-target and of over subsidising a technology that is market ready.

- 1.130 However, renewable natural gas (SNG), a form of biomethane produced from a syngas generated from gasification or pyrolysis, will be included in the development fuel sub-target in recognition that is derived from more advanced processes.
- 1.131 Gasification and pyrolysis enable new and more difficult waste streams to be turned into biomethane, thereby increasing the pool of potential biofuel feedstocks and creating new market demand for them.
- 1.132 We will use the definitions from the Renewables Obligation (RO) and the Renewable Heat Incentive (RHI) for gasification and pyrolysis.

Which fuels would count towards the sub-target?

Consultation proposal

- 1.133 The consultation proposed to restrict eligibility for the sub-target to a limited range of fuel types. We felt this was needed to encourage genuine ‘advanced’ technologies as they cannot compete with fuels made from wastes and residues (included in RED Annex IX) using conventional technologies already on the market.
- 1.134 These new ‘advanced’ production pathways are largely still in development, currently have higher production costs, and appear unlikely to achieve investment without further support. Furthermore, the UK has a greater strategic need for ‘advanced fuels’ that can be used in HGVs and aviation.

Question 8 – Do you agree that each of the other specified fuels (hydrogen, aviation fuel, HVO, biobutanol and fuel that can be blended with petrol or diesel above current limits) should be included?

Summary of responses

Total	Yes	No	Other
66	25	32	9

- 1.135 Just under half of the respondents disagreed with our proposals. As respondents disagreed or agreed for a number of reasons, responses are summarised according to fuel type.

Hydrotreated vegetable oil

- 1.136 A group of 14 fuel suppliers and waste handling companies in the renewables sector (plus two industry representative bodies) did not think that hydrotreated vegetable oil (HVO) should be included. They feared inclusion would undermine UK industry and jobs as imported HVO could fill the sub-target.
- 1.137 Reasons as to why HVO should be eligible included:

- It is a high quality drop-in fuel made using advanced technology which can be produced flexibly from a wide range of feedstocks; and
- The HVO process is approved by ASTM for sustainable aviation fuel production.

1.138 Other comments relating to HVO included:

- HVO needs defining as it is a process that creates other fuels, not just biodiesel; and
- HVO fuels should only be allowed when the feedstocks are considered sustainable wastes or residues, and not when produced from palm oil or PFAD.

Biobutanol

1.139 Respondents, including those from the renewable fuel, fossil fuel, aviation and consultancy sectors, were generally concerned at the inclusion of biobutanol. Their comments included:

- As an oxygenate it should not be included as it risks displacing conventional ethanol;
- As a motor fuel it is not cost efficient as demonstrated in the USA; and
- Biobutanol is subject to similar limitations as bioethanol. Its inclusion could therefore undermine investment in the production of aviation and HGV fuels;

1.140 A public sector body thought that it should be included, pointing out that it has recently been ASTM approved through the alcohol to jet fuel process.

Biopropane

1.141 Seven respondents that included renewable fuel and gas suppliers (and respective industry representative bodies) thought that biopropane should be included for the following reasons:

- it can contribute towards renewable fuel and carbon dioxide reduction targets;
- it can displace diesel in HGVs and can be 'dropped-in' to existing liquid petroleum gas (LPG) vehicles and supply chains without needing modification;
- Using biopropane brings air quality benefits, notably in HGVs and non-road mobile machinery (NRMM); and
- There are several different ways to make biopropane.

'Drop-in' fuels that can be blended at high levels and still meet 'normal' fuel standards

1.142 Whilst one independent advisory group welcomed the inclusion of such fuels, several other respondents raised concerns.

1.143 The same group of 14 respondents who disagreed with the inclusion of HVO, plus an independent representative body for the aviation sector, thought that this concept would also undermine innovation in engines or fuel supply networks and the potential for the UK to attract investment, as suppliers could import the required volumes.

- 1.144 The group of 14 respondents did however think that such fuels could be included, to encourage HGV fleets to switch to higher biofuel blends, where supplemented by another category which supports investment in engine technology.
- 1.145 They also suggested that we allow fuel suppliers more freedom when producing development fuels and to let them work with CEN and the BSI to decide whether the relevant fuel types are suitable for use.
- 1.146 Other concerns regarding the inclusion of such fuels were provided by renewable fuel suppliers and a related industry representative body, and a gas supplier:
- It is too simplistic an approach that might exclude new fuels in the future. We should consider any high blend application and not just those that meet EN590 or EN228, for example original equipment manufacturers' (OEM) engine specifications. A new standard for paraffinic diesel fuels, which includes HVO, was also brought to our attention;
 - Fuels that cannot be blended at high levels can still help to decarbonise transport;
 - This approach could have negative consequences for aviation fuel since blending limits of naphtha (a by-product of the Fischer-Tropsch process) into petrol could mean it is excluded as a development fuel. This uncertainty could affect plant financing;
 - It will not result in a wholesale transition away from petrol and diesel; and
 - This approach becomes less necessary once synthetic fuels, like hydrogen, are available as fuel cells are far more efficient than combustion engines.

Aviation fuels

- 1.147 There was support for including aviation fuel from renewable and fossil fuel suppliers, an NGO, a public sector body and respondents from the aviation sector (including an independent representative body). Comments were provided by an electricity supplier, another NGO, a consultancy and a fossil fuel supplier and included:
- As the basis for inclusion should be carbon savings, aviation fuel (and crude glycerine) should be excluded due to their large carbon footprints;
 - As long as aviation fuels remain exempt from fuel tax, the aviation sector must not receive financial incentives for the uptake of renewable fuels;
 - Aviation fuel made using Fischer-Tropsch technology must be produced by large scale plants to be economic and require local high density feedstock, usually a forest. Research suggests the UK does not have a high enough feedstock density; and
 - Aviation fuels that are not considered as renewable should be included.

Hydrogen

- 1.148 Two renewable fuel and one hydrogen supplier (and an industry representative body), and one NGO, explicitly welcomed the inclusion of hydrogen. The NGO considered that its use should be focused in hard to decarbonise areas and that electricity used in the electrolysis process must be renewable. They also thought that the energy inputs for producing syngas should be renewable, and/or, the process to

isolate the hydrogen should be combined with a process to store or use the carbon dioxide.

1.149 Other comments provided by stakeholders included:

- Hydrogen from steam methane reforming should be included, and it should be explicit that the non-biological energy, such as methanol from carbon dioxide and renewable hydrogen is eligible;
- Hydrogen from renewable power is only economically feasible where there are large amounts of hydroelectric power;
- The definition of hydrogen and level of reward needs to reflect the energy density; and
- Hydrogen is not efficient as an energy carrying system, and additional infrastructure requirements will also limit its efficiency.

Maritime fuels

1.150 Fourteen respondents believed that maritime fuel should be included.

1.151 Other comments included:

- Advanced ethanol production should be included and need not come at the expense of existing conventional ethanol plants if they were converted to produce advanced ethanol. It was also thought that excluding advanced ethanol to protect existing UK crop ethanol production facilities has no place in a free market economy, and places UK suppliers at a disadvantage;
- Another respondent commented that including conventional ethanol was unnecessary, but alternative non-crop paths to ethanol, for example from waste emissions, can contribute to decarbonisation;
- The preference for drop-in fuels is misguided. To encourage the most efficient cars, regulators must stop looking at the engine as distinct from the fuel;
- Waste oils (other than used cooking oil and tallow) that are currently used for biodiesel would cease to be economically viable if they were utilised by fuels in the sub-target;
- Biomethanol and downstream products should be included as they can be deployed quickly at low costs and offer GHG savings and air quality benefits;
- Biobutanol, HVO or fuels blended above current limits should not be included as they are only short term options for road vehicles;
- Fuels must be produced in UK, due to the increased carbon dioxide emissions from importing;
- Picking winners might exclude fuels yet to be developed, and a clear definition of advanced fuel would be preferred;
- The broad range of eligible fuels would not lead to substantial investment in UK development fuel production capacity in the near term. In particular, it was thought that there was a risk that ethers would saturate the sub-target; and
- Synthetic natural gas (SNG) should be included as a development fuel.

Government response – eligible fuels

1.152 Having considered the points raised by stakeholders we can confirm that the following renewable fuels will be eligible for development fuel RTFCs, where made from an eligible feedstock:

- Aviation fuel (avtur or avgas);
- Hydrogen;
- SNG; and
- Fuel that can be blended at rates of at least 25% and still meet the relevant fuel standard i.e. EN228 for petrol, EN590 for diesel.

1.153 The rationales for the first three fuels are set out below. The blending rate percentage is addressed in question 9.

Aviation fuel

1.154 We are proceeding with our proposal to support sustainable renewable aviation fuel through making them eligible for RTFCs. Chapter 2 provides more detail. However, we feel that sustainable renewable aviation fuels are unlikely to attract investment if we do not make them eligible for development RTFCs as well.

1.155 Like any fuel, to claim normal or development RTFCs, aviation fuels will have to meet the GHG savings requirements, ensuring that they provide significant GHG savings.

1.156 As with all development fuels, the feedstock will have to be a sustainable waste or residue.

1.157 The taxation of fuels is outside the scope of this consultation.

1.158 Aviation fuels that are not renewable will not be eligible for any form of RTFC. We however note the potential of low carbon fossil fuels which are discussed in more detail in question 23.

Hydrogen

1.159 In light of the role hydrogen can make towards decarbonising transport, and as it is a novel fuel requiring further support for deployment in transport, we will proceed with our proposal to include renewable hydrogen.

1.160 Renewable hydrogen can be derived from biological or non-biological sources. Renewable hydrogen from non-biological sources is a type of RFNBO (see chapter 2). To qualify for RTFCs, the energy content of the fuel must come from non-biomass derived renewable energy sources, such as, renewable power generated from wind, solar or hydropower.

1.161 Bio-hydrogen must be produced from biomass feedstocks. However, in line with other biofuels we will not require the process energy to be renewable.

1.162 It is good practice (but not a requirement) to re-use or store any CO₂ produced, and this should be reflected in any calculated GHG emission savings in line with the GHG emission calculation rules for biofuels.

1.163 RTFCs, in respect of gaseous fuels, will be issued according to weight. This means that n kilograms of hydrogen will always contain the same amount of energy

regardless of the pressure at which it is supplied. Please refer to question 28 for more details on the level of reward for renewable hydrogen.

Fuel that can be blended at rates of at least 25% and still meet the relevant fuel standard i.e. EN228 for petrol, EN590 for diesel

- 1.164 We believe that including such fuels will ensure that novel fuels of the future meeting the required characteristics are encouraged without needing to revise the legislation.
- 1.165 We note that innovation in engine technology will also drive GHG emission reductions, but this is not within scope of the consultation.
- 1.166 We are not aware of significant volumes of eligible fuels currently available to import from elsewhere. We consider that these proposals provide a significant opportunity to deliver growth, jobs and investment in the UK.
- 1.167 We intend to proceed with making EN590 or EN228 the relevant standard. This is to ensure that novel fuels are suitable for petrol and diesel vehicles sold today, many of which will still be on the road at the end of the next decade. We note the new standard for paraffinic diesel fuels, and the air quality benefits such fuels can offer. We will not however make EN15940 a relevant standard for the purpose of the sub-target as it is not widely recognised by vehicle manufacturers, but will keep the issue under consideration for future policy.

Renewable SNG

- 1.168 The rationale for including renewable SNG is explained in our response to question 7.

Government response – ineligible fuels

- 1.169 The following fuels will not be eligible for the sub-target:

- HVO diesel;
- Biobutanol, and other oxygenates;
- Biopropane; and
- Maritime fuels

- 1.170 The rationale for these decisions is set out below.

Hydrotreated vegetable oil

- 1.171 We acknowledge that HVO diesel can be blended at high levels in HGVs and other diesel vehicles, and that it can offer improved fuel quality. However, HVO is already a commercially available fuel. Furthermore it uses largely the same waste feedstocks already used in fatty-acid-methyl-ester (FAME) production, and therefore does not expand the overall feedstock base that can be converted to biofuels.
- 1.172 The aim of the development fuel sub-target is twofold; to produce fuels that can be used to help decarbonise HGVs and aviation in the longer term, but also to drive innovation in processing new types of waste feedstock. We consider that the inclusion of HVO could undermine the latter and saturate the sub-target. We also note the concerns that it could undermine UK industry and investment.

Biobutanol, and other oxygenates

- 1.173 We note the concerns raised by stakeholders regarding the inclusion of biobutanol given its similarities to bioethanol and other fuel oxygenates. We have therefore determined not to include it as a development fuel.
- 1.174 In respect of cellulosic ethanol, which is discussed in the summary of responses to question 5, the consultation document highlighted its limited potential given that it is constrained by both blending limits and the forecast decline in the wider UK petrol market. It also explained that any significant expansion could come at the expense of existing UK crop bioethanol production facilities. In light of these concerns, we will not include cellulosic ethanol as a development fuel.

Biopropane

- 1.175 LPG, which comprises propane and butane, can be used in specially adapted spark-ignition engines, usually in the light vehicle market.
- 1.176 As outlined above, a key aim of the sub-target is to support fuels suitable for aviation and HGVs. We are not aware of biopropane being used as aviation fuel and, as the HGV fleet is predominantly diesel, LPG use has been extremely limited. We note that it may be possible to re-engineer diesel engines to run on LPG or to burn a mixture of diesel and LPG but this practice is not widespread and the viability of this technology is not well understood.
- 1.177 We do however acknowledge the potential it has to contribute to decarbonising transport. In 2015 we increased the reward from 1 to 1.75 RTFCs per kg, and double that amount when the fuel is produced from wastes and residues. We consider that this support reflects the advantages biopropane offers.

Maritime fuels

- 1.178 For the reasons outlined in paragraph 1.61 we do not intend to bring maritime fuels into scope of the RTFO.

Other stakeholder concerns

- 1.179 Clarification on the other points raised by stakeholders is provided below.
- 1.180 Our response to question 5 explains why we are not including cellulosic ethanol as a development fuel. One of these reasons is that ethanol is constrained by a low blend limit, which will also apply to ethanol derived from waste.
- 1.181 For reasons outlined in response to various questions in this chapter we consider that limiting feedstock and fuel eligibility is needed to encourage advanced fuels, made from a wider variety of genuine wastes, which can be used in sectors difficult to electrify.
- 1.182 We believe this policy strikes the right balance between encouraging novel fuels and ensuring that they are suitable for the vehicle fleet in the coming decades. The development of engine technology is outside the scope of this consultation.

- 1.183 Our approach to excluding segregated oils and fats should mean that the development fuels target encourages technologies that can use a wider variety of waste feedstocks, rather than compete for the same finite feedstock resource.
- 1.184 We will not require fuels to be produced in the UK, but all fuels will need to meet the minimum GHG savings threshold. Fuels produced in the UK may be at an advantage if their transportation emits less GHG emissions than those being imported.
- 1.185 We noted the concern that some of the fuels originally included in the sub-target would not lead to substantial investment in UK development fuel production capacity in the near term, and that there was a risk that some would saturate the sub-target. We have addressed these concerns by excluding fuels derived from all segregated oils and fats, narrowing the list of eligible fuels and setting an appropriate blend limit for the catch all category.

Ensuring that novel fuels continue to be incentivised in the future

Consultation proposal

- 1.186 The final development fuel category is intended as a ‘catch-all’ to ensure that novel fuels meeting the required characteristics are encouraged and incentivised without needing to revise the legislation for individual fuels.
- 1.187 We proposed to include fuels that can be blended at rates of at least [x] % and still meet the relevant fuel standard (EN228 for petrol and EN590 for diesel) as a development fuel. We asked which minimum blend rate would effectively promote fuels with significant additional benefits over today’s conventional biofuels.

Question 9 – For those development fuels that can be blended with standard fuels, at what level should the minimum blend capability requirement be set, whilst still meeting the relevant fuel standard? a) 15% b) 20% c) 30% d) Other

Summary of responses

Total	15%	20%	30%	Other %	Other comment
49	6	0	5	28	10

- 1.188 The majority of respondents, including renewable and fossil fuel suppliers, plus industry representative bodies for both, opted for a different percentage. Two main proposals emerged:
 - 1 Any level above EN228 and EN590 specification for biofuels; and
 - 2 There should be no blend limit.
- 1.189 The first point was made by 14 respondents, including fuel suppliers and waste handling companies in the renewables sector, and two industry representative bodies, who said that it is impossible to meet EN228 and EN590 above their limits on biofuel blending since this is an integral specification. They went on to note that the fuel should not have to meet EN590 or EN228 as doing so would discourage

development in the transport sector. An independent advisory body also said that the limit should be any blend greater than the existing maximum blend.

1.190 The second point was raised by eight fossil fuel suppliers and an industry representative body said. Their reasons for opposing a blending limit included:

- We should not disadvantage the UK fuels and renewables industry by imposing rules which may limit carbon savings and bring unintended consequences. Anything that increases the biogenic content in fuel can be an important contribution to meeting the overall target and should not be excluded;
- Each supplier has their own base fuel and should be free to determine their own blend levels as required. They need this freedom to meet their shortfall and not create a false demand for a very finite resource; and
- Setting a minimum blend level would make it difficult to bring new fuels and technologies to market and for them to be delivered at commercial scales.

1.191 Other comments as to why a blending approach may be unsuitable were provided by a consultancy, renewable fuel suppliers, an independent advisory group and a gas supplier. Their comments included:

- The blend limit will differ between fuels and more research is needed to determine the correct level for each fuel type so to avoid unintended consequences;
- There are better solutions for defining development fuels, such as focusing on aviation or on technologies that do not have many plants in the market; and
- To retain flexibility when deciding which fuels qualify for the sub-target.

1.192 The fossil fuel sector, including an industry representative body, also raised concern over how we propose to apply the fuel standards. It was noted that:

- Fuel standards should not be used as a reference point because they do not differentiate between renewable and fossil components;
- It is for CEN and BSI to decide whether new fuels will be fit for use in vehicles, and if so at what blend. They may decide that a new fuel requires a new specification or further controls are needed in EN228 or EN590, as was the case for FAME and ethanol; and
- Government should not consider adjusting blending capacity without reference to the standard setting bodies.

1.193 They also thought the proposal was too loose, risked over simplifying the situation, and questioned how it would be applied. They suggested that the Administrator should decide if a fuel is renewable and then CEN and BSI can determine the appropriate blend limit for that fuel.

1.194 Other comments from those agreeing with another percentage were provided by renewable and fossil fuel suppliers. These included:

- The limit should be very high, such as 75% and 95%, otherwise we are just creating a new blend wall that will not lead to full decarbonisation of HGVs or aviation, or significant air quality improvement;
- That fuels which can be blended to high levels can be supported through double-counting under the standard RTFO, but the sub-target should be reserved for fuels that can clearly demonstrate a route to unblended use (i.e. truly 'drop in' substitutes);

- The limit should start at 30% but rise to match the availability, technological maturity and cost of best technologies, potentially reaching 50% or 60%, or up to 100% for second generation biorefineries;
- We should consider scale potential and technology access as feedstocks that are limited will not deliver substantial GHG savings;
- That a technology licensing provision would enable rapid uptake of new technologies;
- The target for SNG can be set at any level when used with natural gas, as they have the same properties; and
- It is important to consider what is stated by the automotive manufacturers concerning suitable fuel types for the existing vehicle fleet, as this might limit the use of some future fuels if new CEN standards are needed.

1.195 Those that provided a reason for setting the limit at 15% included a renewable fuel supplier, an academic institution and one public sector body. Reasons included:

- This would provide an incentive, but fuels should also be capable of higher blends (potentially when economies of scale and learning-by-doing apply);
- Blended fuels can be disruptive to older and vintage vehicles. They noted that it was important to set a level that protects users of older vehicles, while accelerating the adoption of new vehicles that can use blended or synthetic fuels; and
- As the minimum blend reported for commercial flights was 15%, this would be in line with global activities and a realistic target whereas a higher blend may be a barrier to uptake. However, one independent representative body for the aviation sector did suggest that any certified fuel, at any blend level, should be eligible subject to the sustainability/feedstock requirements.

1.196 Two renewable fuel suppliers provided reasons for setting the limit at 30%. One pointed out that the current fuel standard for high biodiesel blends permits B30. The other thought that we should not displace current low carbon fuels through the adoption of other low carbon fuels to little or no benefit for the environment.

Government response

1.197 We will proceed with the proposal set out in the consultation document. However, we consider further clarification is needed to address comments from stakeholders as to how the proposal will work in practice.

1.198 Any fuel that is to be considered a development fuel through the 'catch all' category would need to meet all the requirements of EN228 for petrol or EN590 for diesel. This includes not only the limits of the identified parameters of the fuel, such as oxygen levels, but all the other requirements, in particular the general workmanship clause to ensure that fuels brought to the market are always compatible with the vehicle fleet.

1.199 Our proposal was to make a fuel eligible for the sub-target where it could be blended above a given percentage, whilst still meeting the relevant standard. We understand this to be possible as the standards do not specify an upper limit for the renewable fraction except in a few instances, FAME and ethanol for example.

1.200 This proposal therefore provides a means for 'drop-in' fuels with sufficiently similar characteristics to today's petrol and diesel to claim development RTFCs without

Government having to revise the legislation each time a particular fuel type is developed.

- 1.201 Having considered stakeholder comments we will set the minimum blend limit at 25% for the catch-all category. **It should be noted that this refers to the renewable fraction of the final fuel, not the fraction of the fuel that was blended with petrol or diesel.** E.g. if a novel fuel is 50% renewable, and is blended in equal parts with regular fossil diesel, the relevant fraction for the purpose of this policy would be 25%.
- 1.202 We consider this is an appropriate level for the following reasons:
- It would prevent commercially available fuels already supplied under the RTFO today, such as ethers, from saturating the sub-target; and
 - It supports fuels that can be blended at greater levels than today's biofuels, which will require a greater level of support to be developed. Whilst we acknowledge that lower blend biofuels can contribute to decarbonising transport we do not think they require the additional support that development fuel status will provide. They will continue to be supported through normal RTFCs.
- 1.203 Clarification on the points raised by stakeholders is provided below.
- 1.204 Fuel suppliers will be able to blend renewable fuel at the rate they require. The fuel, once demonstrated that it can be blended with a resultant renewable fraction above 25%, whilst still meeting EN228 or EN590, will be eligible for development fuel RTFCs regardless of the blend it is supplied in.
- 1.205 Aviation fuel, nor any of the other development fuels specifically listed in the definition, will need to comply with the minimum blend limit.
- 1.206 Fuels can be produced from any waste or residue which the Administrator has assessed as eligible for double reward (see question 2 for further details), apart from segregated oils and fats

Increasing the supply of advanced biofuels

Consultation proposal

- 1.207 In addition to proposing a sub-target for specific advanced fuels to provide the industry with long-term investment certainty and incentivise production cost effectively, the consultation sought views on whether there are further or alternative measures to minimise costs.

Question 10 – Are there ways in which we can increase the supply of advanced biofuels in a cost-neutral way?

Summary of responses

Total	Yes	No	Other
42	25	8	9

- 1.208 There were in total 42 respondents to this question, mainly from the renewable and fossil fuel sectors, the aviation sector as well as industry consultants and academia. Twenty-five respondents were of the opinion that the Government could take further

measures in a cost-neutral way, while eight respondents (including renewable fuel suppliers, consultancies/advisory bodies and fuels suppliers) disagreed and nine respondents provided comments without giving a definite “yes” or “no” response.

1.209 Irrespective of whether respondents answered the question with “yes” or “no”, many of the suggestions for further measures were similar, and effectively required public support of some kind. Those respondents that answered “no” concluded that no cost-neutral option would be available in the short to medium term, referring to the fact that economies of scale and technical development would only be able to drive costs down with time. Other respondents asked how cost-neutrality would be defined, pointing to wider long-term benefits of supporting technology development.

1.210 The suggestions that were made by respondents can be grouped as follows:

- **Government strategy and cross-departmental coordination:** Almost a quarter of the responses stressed the need for clear Government messaging as well as commitment to advanced biofuels. Coordination across Government was considered essential, in particular in relation to strategies on waste and industrial development. In view of different support schemes, some respondents pointed out a need for a level playing field across energy sectors (some asking for the transport sector to be prioritised). The value of building knowledge networks and supply chains, as well as international coordination, were among further suggestions;
- **Grants, loan guarantees and tax rewards:** Even though not necessarily a cost-neutral measure, 13 responses pointed to problems of bringing research and development projects to commercial deployment and that more needed to be done to close that gap, in particular in relation to first-of-a-kind commercial plants (referring to schemes available in other countries). Some respondents remarked positively on the Advanced Biofuels Demonstration Competition and asked for its continuance;
- **Multiple rewards:** Seven respondents, in particular fossil fuel suppliers, promoted the idea of counting RTFCs for advanced fuels three or four times rather than providing further fiscal incentives;
- **Demand side measures:** Six respondents saw the need for more demand side measures. Suggestions included duty incentives, encouraging use of higher blends (e.g. E10, E20, E25 or E85), and educating fleet operators on benefits of low carbon fuels; and
- **Changes to the RTFO and further suggestions:** Other suggestions made included setting higher RTFO targets, raising the buy-out price of the RTFO, remodelling the RTFO to a fixed-price scheme along the model of the Contracts for Difference as well as limiting the export of waste and residues (unless for biofuels production).

1.211 When responding to the question, several respondents also raised the concern that the current set-up of the RTFO would only incentivise fuels that are already market-ready and argued against defining development fuels too restrictively. In their view, the Government should allow for a broad selection of fuels, provided these meet the sustainability and greenhouse gas saving criteria (though some respondents also argued for excluding some of the ‘more advanced’ fuels from the development fuels target). At the same time, some respondents asked for more fuel specific measures and strategies.

Government response

- 1.212 The Government welcomes the suggestions made by respondents and notes in particular the need for consistent messaging and joined up Government strategies. The Department for Transport is working with other Government Departments to deliver on these.
- 1.213 Most of the measures suggested by respondents require some form of public support, or redistribute costs along the value chain. The Government view is that further analysis would be required to determine the specific costs and benefits before taking new measures forward. However, the Government will take the suggestions into consideration when reviewing the policy in the future.
- 1.214 The Government is currently supporting research and development, and commercial deployment. In addition to the two Advanced Biofuel Demonstration Competition the Government has made £22m of grant funding available under the Future Fuels for Flight and Freight Competition (F4C) to develop advanced fuels which are of most strategic value to the UK, and focus on the difficult-to-decarbonise aviation and HGV sectors. Furthermore, the Department for Transport is co-funding the Sustainable Aviation Special Interest Group with the Knowledge Transfer Network, to accelerate the domestic production of sustainable fuel through strategic business solutions.
- 1.215 In so far as the suggestions refer to proposals made in the consultation (such as changes to the RTFO, multiple rewards or the definition of advanced fuels), a more detailed Government response can also be found in the relevant sections of this document.

Assuring novel fuel volumes

Consultation proposal

- 1.216 In the consultation, the Government proposed to introduce a new sub-target for 'development fuels'. To be issued with a 'development RTFC', the RTFO Administrator would be given the power to determine whether the fuels/feedstocks meet the required criteria (e.g. whether the fuel can be blended above a certain percentage and meet appropriate fuel standards). The consultation proposed to give the Administrator the power to require independent assurance of the fuel volume when necessary, and sought views on whether this measure would be appropriate.

Question 11 – Do you agree that for novel fuels it is appropriate for the Administrator to require independent assurance of the volume of fuel when necessary?

Summary of responses

Total	Yes	No	Other
54	46	7	1

- 1.217 There were in total 54 responses to this question, of which a clear majority (46 respondents, from different sectors) supported the new power to require independent

assurance for novel fuels when necessary. Seven respondents, all from the fossil fuel industry, did not consider the measure appropriate.

- 1.218 Those supporting the proposal included renewable fuel suppliers, NGOs, industry consultants, academia, organisations from the aviation sector and fossil fuel suppliers. Respondents agreed that independent assurance could be critical to prevent fraud and confirm claimed volumes, especially as novel fuels may present problems in terms of fuel measurement. They also pointed out that this would create a level playing field for the industry, and may be critical for the credibility of the sector and public support. One respondent considered that the approach should also be applied to novel fuels currently part of the RTFO.
- 1.219 However, of the 46 respondents that supported the change, seven respondents from a variety of sectors including the fossil fuel sector, consultancies, academia and the aviation sector caveated their support. While they considered it important for the Administrator to have the option of requiring independent assurance, they highlighted that this should only happen “when necessary” and should align with existing processes in order not to create additional burdens. Two industry bodies were of the opinion that independent assurance might only be needed in the aviation sector. One representative body from the aviation sector pointed out that the approach in this sector should ultimately align with global accounting standards by the International Civil Aviation Organisation (ICAO), which are currently under negotiation, in order to avoid duplication and costs.
- 1.220 The seven fossil fuel suppliers that considered the proposal not appropriate were of the opinion that there would be no reason to treat novel fuels any differently than other fuels, given that the existing verification process has proven successful.
- 1.221 Two respondents (including one respondent that did not state “yes” or “no”) voiced more general concerns in relation to the question, i.e. that some novel fuels might not meet the blending limit and fuel standards as set out in the consultation document and so might not qualify.

Government response

- 1.222 The Government’s view is that a different treatment of novel and advanced fuels is justified given that additional rewards are available, this is a new area and it will be critical for Government and industry to prevent fraud.
- 1.223 We note the concerns raised and will only request assurance when necessary, considering each application on a case by case basis, taking into account the costs and administrative burden for fuel suppliers.
- 1.224 It is too early to determine how future ICAO accounting standards will impact on this policy area. However, the outcome of the current negotiations will be taken into account at any future policy review. For more detail on the Government position on the definition of novel fuels please see questions 8 and 9.
- 1.225 Overall, having considered the responses and concerns raised, the Government has decided to provide the Administrator with the discretion to request independent assurance of fuel volumes for ‘development fuels’ to either a ‘limited’ or a ‘reasonable’ level of assurance.

Non-road mobile machinery

- 1.226 In addition to applying this approach to ‘development fuels’, the Administrator will also have discretion to require either ‘limited’ or ‘reasonable’ levels of assurance for

the volumes of renewable gaseous fuels used in non-road mobile machinery. These fuels, which we intend to make eligible for RTFCs, are not subject to excise duty. Independent assurance will therefore provide an alternative means of validating fuel volumes in the absence of data being reported to HMRC.

Levels of assurance

Consultation proposal

1.227 Further to question 11, the consultation also sought views on whether the Administrator should have the powers to require independent auditing up to a ‘reasonable assurance’ (rather than ‘limited assurance’) when assessing whether a fuel qualifies for the ‘development fuels’ sub-target.²

Question 12 – Do you agree that for novel fuels the RTFO Administrator should have the discretion to require a ‘reasonable’ level of assurance rather than a ‘limited’ level?

Summary of responses

Total	Yes	No	Other
51	38	12	1

1.228 Fifty respondents commented on the proposal, of which 38 supported the possibility for the Administrator to require ‘reasonable assurance’ (including many renewable fuels suppliers, NGOs, industry consultants, fossil fuel suppliers and aviation sector), while 12 renewable fuel and fossil fuel suppliers disagreed with the measure. One renewable fuel supplier provided a general comment without stating support or opposition to the proposal as such.

1.229 Those respondents that supported the change were of the opinion that the measure could prevent fraud, ensure that funding and rewards are correctly awarded (especially as ‘development fuels’ would receive double rewards). As such, one gas supplier pointed out, the measure could secure credibility and public support. Another respondent also highlighted the benefit of having discretion for the Administrator to accommodate a wide range of fuels and approaches. One renewable fuel producer caveated their response by stating that the term ‘reasonable level’ needs to be clearly understood and the process should not create additional burdens. Further comments included the suggestion to widen the approach to all fuels that receive Innovate UK funding.

1.230 Respondents that disagreed with this power for the Administrator argued that ‘development fuels’ should be treated the same as any other fuel under the RTFO and the same ‘limited’ level of assurance should apply. They referred to the costs such an audit may incur as well as the additional time the process may require, leading to higher risks and financial uncertainty for developers. One industry body agreed that ‘reasonable assurance’ could help preventing fraud in long supply chains

² The terms ‘limited assurance’ and ‘reasonable assurance’ are set out in the International Standard on Assurance Engagements 3000.

but also referred to measures already in place, including the requirement to comply with the waste hierarchy and sampling on an ‘at risk’ basis. They suggested to keep the current approach under review and only to propose changes should it become evident that the current approach is insufficient.

1.231 In line with their responses to question 11, respondents also repeated their concerns that not all ‘development fuels’ may meet the criteria set out in the consultation and that the final approach in the aviation sector should be in line with the outcome of the ICAO negotiations on a global accounting standard.

Government response

- 1.232 The Government is pleased to note to that a majority of stakeholders agreed with the proposed change.
- 1.233 We will provide the Administrator with the power to request independent assurance, and have the discretion to require either a ‘limited’ or ‘reasonable’ level of assurance.
- 1.234 The Administrator will only use this additional requirement when necessary and after careful consideration of the costs and benefits associated with requiring a higher level of assurance in each case.

Setting a level for the supply of crop based biofuels

Consultation proposal

1.235 As part of a set of measures to increase the supply of the most sustainable, waste-based fuels and prevent ILUC, the consultation document proposed to set a maximum level for the proportion of fuels made from crops that could be used to meet the RTFO. Consultees were asked to state a preference for a limit of either 0%, 2%, 7% or “other”, with the consultation document and the cost benefit analysis setting out in more detail the potential costs and benefits of each option.

Question 13 – For both 2020 and 2030 at what level should the supply of crop derived fuels be set? a) 0% b) 2% c) 7% d) another percentage

Summary of responses

Total	0%	2%	7%	Other
576 (480 campaign)	6	20	537(480 campaign)	13

1.236 Including campaign responses, five hundred and seventy-six respondents answered this question, of which a majority supported a 7% cap (or as close as possible), including 480 campaign and 57 individual responses. The individual and campaign responses came from a variety of sectors, including the renewable fuel, fossil fuel, farming sectors as well as local authorities. Twenty respondents (mainly from the biodiesel sector) favoured the 2% option, while four environmental NGOs advocated the 0%.

- 1.237 In addition, a number of alternative options were suggested. These included different figures between 3 to 5% as well as suggestions for a scaling target (either from 5% in 2020 to 3.8% in 2030, 2-3.5% to 0%, or 7% to 0%). One renewable fuel supplier and one individual from academia did not want to see a limit at all, arguing that the policy was based on the wrong premises and arguing for a system based on greenhouse gas (GHG) emission savings respectively. Two renewable fuel producers chose 0% but asked for further flexibility and exemptions (e.g. for energy crops and rotation crops), as did one respondent for the 2% limit. Another renewable fuel producer listed principles (for example, providing greenhouse gas savings) but did not give any specific recommendation.
- 1.238 Many respondents submitted substantial responses to this question. Overall, the arguments for the different options can be grouped as below.

Arguments for the 0% limit

- 1.239 Supporters of the 0% limit argued that a negative impact of crop-based biofuels in the form of ILUC has been proven and as such this type of biofuel has been discredited. They referred to studies showing that, when ILUC is taken into account, many crop-based biofuels only provide minimal emission savings or even increase emissions compared to fossil fuels. This impact would also reflect the significant land-take required and the impact on the environment and wildlife.
- 1.240 They argued that even crop-based biofuels that can deliver emission savings would not be the most-efficient use of land (e.g. when compared solar cells delivering more energy per hectare). Given increasing pressures on land, crop derived fuels would therefore need to be phased out. Instead, the policy should focus on biofuels from waste and residues, with robust sustainability criteria in place, as well as renewable electricity in order to decarbonise the transport sector.
- 1.241 Some of the NGOs also raised doubts as to the effectiveness of the current sustainability criteria for biofuels and their governance regime.

Arguments for the 2% limit

- 1.242 Supporters of the 2% limit considered it to provide the right balance to allow the UK both to increase demand in waste and still benefit from the greenhouse gas savings that bioethanol in particular can achieve. While for example one biodiesel producer expressed concerns that any further expansion of crop-based biofuels would erode investments into waste biofuels (and thus could not support a 7% limit), the respondent agreed with the majority that the investments of conventional biofuels producers should be safeguarded. This would be both to maintain investor confidence and encourage conventional biofuels producers to invest in waste. These respondents generally considered that a 2% limit would still allow for the uptake of E10, whilst incentivising the uptake of waste bioethanol.
- 1.243 Some biodiesel producers also used the opportunity to flag other measures they considered necessary to promote waste-based biofuels in addition to the crop cap. These included a higher buy-out price (or removal of this option), the Government's waste policy and waste imports (e.g. allowing the import of non-EU used cooking oil).

Arguments for the 7% limit

- 1.244 Supporters of the 7% limit argued in particular with reference to the importance of the UK's three existing bioethanol plants for the local and national economy. They highlighted the positive impact the industry has had not only in terms of jobs (directly and in the supply chain) in the North East of England but also for farmers growing feed wheat and sugar beet. Selling their crops to the industry would have provided farmers with an additional, less volatile market, which would be of particular importance given the current uncertainties caused by the UK's decision to leave the EU. At the same time, the protein feed produced as a co-product of bioethanol production would reduce the UK's import dependency in this area.
- 1.245 Those arguing for a 7% crop cap considered that neither the 0% nor the 2% would be sufficient to sustain the UK bioethanol industry which has not yet reached its full capacity, thus allowing it to recoup its investments. A lower crop cap would lead to plant closures and job losses both in the industry and along the supply chain. In their view, a lower cap would also not allow for a full introduction of E10 and therefore cause a major problem for the decarbonisation of petrol cars which are not yet to be replaced by electric cars. Closure of the plants would also lead to a drop in investor confidence in the whole sector and those initial plants would be in no position to invest in second generation biofuels. Respondents further argued that safeguarding the existing industry would allow further research not only in advanced biofuels but also farming practices, and referred to wider benefits such as the industry's contribution to the UK's renewable and carbon budget targets, energy security and infrastructure.
- 1.246 Supporters of the 7% level highlighted the positive GHG emission savings bioethanol can achieve and the relatively low indirect land change use risk, questioning the justification for the crop cap. Fossil fuel suppliers referred to sustainability and GHG emission criteria as a more effective tool to avoid ILUC. Some respondents suggested a direct ban on crop-based biodiesel as an alternative or stressed that palm oil, the most problematic feedstock, hardly plays a role in UK biofuel supply. Supporters often questioned the assumed link between demand for biofuels and a rise in food prices, referring to different studies, and pointed out methodological issues in terms of accounting for ILUC.
- 1.247 Increased flexibility and risk of a competitive disadvantage were other arguments used by supporters of the 7% limit, particularly from the fossil fuel sector. Respondents referred to the fact that the ILUC Directive sets an EU-wide crop-cap at a maximum of 7% and that the cost benefit analysis illustrates that 7% limit is the least cost option. Some respondents also pointed out that the limit would not necessarily translate into a 7% share of crop-based biofuels, but would allow flexibility, e.g. fuel suppliers would have more choice when it comes to blending (which may be required both for costs and quality reasons). A 7% limit would also be able to accommodate different developments such as a rise in costs for waste feedstocks due to limited supply, slower electrification, lower dieselisation and a roll out of E10 and possibly higher blends in the future.

Arguments for alternative options

- 1.248 Those respondents arguing for alternative options, considered the balance between steering the industry towards the use of waste feedstocks and safeguarding current

investments would be better achieved through a higher limit. In line with the recent Commission proposals for the revised RED, some respondents also suggested to reduce the crop cap level with time to ensure that the transition takes place. Those arguing for special exemptions often referred to particular benefits of specific biofuels (such as crop-based biofuels grown on idle land, or of low ILUC risk).

Government response

- 1.249 The Government welcomes the significant interest shown in response to this question and extensive arguments submitted, noting also the high number of individuals and campaigns who responded to the question.
- 1.250 After careful examination of all the arguments and evidence submitted, the Government has decided that a sliding limit from 4% in 2020 to 2% in 2032 strikes the best balance. This approach would limit the contribution from crop-based biofuels towards the renewables targets at 4% in 2018 and reduce the contribution from 2021 onwards to 3% in 2026 and 2% in 2032 (see table below).

Table 3 RTFO crop cap level 2018-2032

Obligation year	Maximum share of crop derived fuels rewarded RTFCs (volume)
15.4.2018-31.12.2018 (RTFO Year 11)	4.00%
2019 (RTFO Year 12)	4.00%
2020 (RTFO Year 13)	4.00%
2021 (RTFO Year 14)	3.83%
2022 (RTFO Year 15)	3.67%
2023 (RTFO Year 16)	3.50%
2024 (RTFO Year 17)	3.33%
2025 (RTFO Year 18)	3.17%
2026 (RTFO Year 19)	3.00%
2027 (RTFO Year 20)	2.83%
2028 (RTFO Year 21)	2.67%
2029 (RTFO Year 22)	2.50%
2030 (RTFO Year 23)	2.33%
2031 (RTFO Year 24)	2.17%
2032 (RTFO Year 25)	2.00%

- 1.251 As the consultation document and the responses received made clear, different interests and arguments need to be carefully weighed up against each other on this measure. There are a variety of factors that need to be taken into account when setting the limit, these include ensuring the level supports the uptake of waste feedstocks, and limits the risks of increases in emissions from indirect land use change.

- 1.252 From an environmental perspective, to reduce the risk of ILUC and encourage further uptake of waste-based biofuels, a crop cap significantly below the 7% set at EU level is required, with environmental groups having argued for a limit as low as 0%. In the consultation document, the Government therefore stated a preference for a 2% limit. However, the Government notes that there were a number of concerns raised that this limit still might not strike the right balance (most notably in relation to the bioethanol industry and general flexibility to deal with different future scenarios).
- 1.253 While the majority of respondents stated their preference for a limit as close as possible to 7%, the Government maintains that, on the basis of all the evidence, a 7% limit would not be the right approach nor necessary to address the concerns raised. The current share of crop-based biofuels in the UK is at about 1.5% on an energy basis (equivalent to 2% on a volume basis) and none of the scenarios modelled for the CBA indicated that a 7% crop share would be reached. Even assuming a rather extreme scenario with a market penetration of E10 as high as 95% in 2020, within a low dieselisation scenario (where we examine the potential impact of a reversal in the dieselisation trend, which has seen an increase in the demand for diesel),³ the resulting bioethanol share would effectively not exceed 3.34%.
- 1.254 A 7% limit would therefore set the wrong signal, risking encouraging a significantly higher share of crop-based biofuels rather than providing an incentive for investments into waste-based biofuels. Setting the limit so far in excess of what is required risks that the share is filled up by less desirable fuels than bioethanol that may increase GHG emissions rather than reduce them.
- 1.255 At the same time it is not the Government's intention to stop the use of crop-based biofuels that deliver greenhouse gas savings, nor to jeopardise UK investments and jobs. The Government recognises that sufficient flexibility should be provided for industry to meet its targets with minimal impacts to consumers under a range of future scenarios (e.g. introduction of E10, lower dieselisation rates or slower electrification).
- 1.256 Having reviewed the evidence, the Government has therefore decided to set the limit initially at 4%. This should allow enough flexibility to the industry and provide a sufficient market for the UK's existing bioethanol facilities, whilst the gradual tightening of the limit will provide a clear signal as to future investments for the transition to the most sustainable fuels.

Using indirect land use change definitions

Consultation proposal

- 1.257 In relation to crop-based biofuels (see also question 13), the consultation proposed to use the same definition of "crops" as that contained in the ILUC Directive. This definition requires a further definition of the term "starch-rich crops" for which the consultation also proposed to use the definition in the ILUC Directive. The consultation sought views about whether using these definitions could have unintended consequences.

³ For comparison, Finland, the European country with the highest reported E10 share only has a market penetration of 63%. For the "low dieselisation scenario" a split between diesel and petrol use plateaus in 2016 and 2017, with a declining diesel share from 2017 until 2026 at the same rate at which it increased between 2007 and 2016 and this split staying constant after 2026 is assumed.

Question 14 – Do you anticipate any unintended consequences as a result of basing the definition of crop and starch rich crops on that provided by the ILUC Directive?

Summary of responses

Total	Yes	No	Other
48	27	18	3

1.258 Forty-eight respondents answered this question, of which 27 expressed concerns that basing the definition of crop and starch rich crops on that provided by the ILUC Directive may have unintended consequences. These included renewable fuel suppliers, fossil fuel suppliers, NGOs and academia. Eighteen renewable fuel suppliers, fossil fuel suppliers, representatives from the farming sector as well as industry consultants and advisory bodies saw no risk of unintended consequences. Three respondents did not respond to the question directly with ‘yes’ or ‘no’ but provided comments.

1.259 The term ‘unintended consequences’ in the question was interpreted widely by respondents and many comments were focussed on the policy rather than issues with the definition per se.

1.260 The concerns and questions regarding the definition included the following issues:

- No materials listed in Annex IX of the RED or the RTFO wastes and residues list should be included in the crop definition (e.g. rapeseed residues or sugar beet tops, which could be counted either as wastes or crops) to allow innovation into novel fuels. This concern was raised by 13 respondents from the biodiesel industry;
- Definition of the term “primarily for energy purposes”: Three respondents from the renewable fuels sector sought clarification how this part of the definition would be interpreted;
- Exemptions for specific crops: Two responses from a renewable energy supplier and academia asked to exempt specific crops, i.e. those that provide ecosystem services (e.g. biomethane from grass) or domestically produced starch-rich foods not intended for the food chain; and
- Non-food energy crops grown on contaminated and degraded land: one fossil fuel supplier asked for further clarification of how these would be treated.

1.261 Those that agreed with the definition generally provided little commentary, though one fossil fuel supplier remarked that definitions should be aligned with the ILUC Directive in order to ensure a level playing field. Seven respondents from the renewable fuel and farming sectors, while agreeing with the definitions, stated their disappointment that the Government had not included a definition of “low indirect land use change risk biofuels”, which, even though potentially challenging to certify, could provide further flexibility. One renewable fuels supplier also highlighted the need to clearly define residues and their greenhouse gas accounting process.

1.262 Of the three industry bodies that did not answer the question with ‘yes’ or ‘no’, two referred to their answer in question 13, where they had asked for more flexibility regarding the crop cap, while one industry body remarked that all non-food energy

crops should be exempted, and food and feed crop residues as well as cover crops be regarded as residues and wastes for the purpose of the crop cap.

1.263 Several respondents also used this question to restate their arguments for and against the crop cap and any unintended consequences the overarching policy could have.

Government response

1.264 The Government notes the concerns raised. In regards to the qualification of the crops as “primarily for energy purposes” the Government acknowledges that the formulation as contained in the ILUC Directive may lead to confusion in particular in relation to energy crops.

1.265 Energy crops are not intended to fall under the crop definition. We will seek to clarify this in the legislation.

1.266 In terms of the term ‘low indirect land use change risk biofuels’ the Government is of the opinion that this definition will require further work in order to be made operational. However, the Government will look into how the ‘low indirect land use change risk biofuels’ definition could be made operational in the future.

Labelling crop derived fuels and limiting crop RTFCs

Consultation proposal

1.267 As a practical means of operating the ‘crop cap’, the consultation document proposed to label RTFCs as ‘crop’ according to their feedstock, and limit the maximum number that each supplier can redeem in a single year. The consultation asked stakeholders whether they agreed with this proposal.

Question 15 – Do you agree with the labelling of RTFCs for crop derived fuels as ‘crop’ and the proposal to limit the number of ‘crop’ RTFCs that can be redeemed in a single year?

Summary of responses

Total	Yes	No	Other
51	45	6	1

1.268 Fifty respondents provided comments on this question, with the majority (45 responses) agreeing in general and six objecting to the proposed mechanism.

1.269 Organisations that supported the proposals were mainly from the renewable fuel, farming, fossil fuel, and waste sectors as well as industry consultants, academia and NGOs. They generally remarked that this measure seemed sensible and allowed for transparency.

1.270 Eight fossil fuel suppliers and industry bodies expressed the view that any remaining crop RTFCs should be available for trading and/or carry over as is the

case today in order to allow suppliers to meet their obligation in the most cost-effective way.

- 1.271 Nine respondents from the renewable fuel, fossil fuel and farming sectors, used this question to re-voice concerns about the level of the proposed cap and, while supportive of the measure, made their support dependent on a 7% crop cap.
- 1.272 The six respondents that rejected the proposal were from the renewable energy and fossil fuel sector as well as academia. Two respondents (from academia and the fossil fuel sector) stated a preference for the carbon intensity of a fuel determining its value and were of the opinion that a declaration of the GHG benefit would be more sensible. One of them also raised concerns that the introduction of 'crop' RTFCs would distort the market and introduce a two-tier system. Two organisations raised concerns in relation to the role of energy crops (one wanted energy crops included in the cap, the other wanted them excluded), and one fossil fuel supplier wanted more details on how excess crop RTFCs would be treated before agreeing to the proposal.

Government response

- 1.273 The Government is pleased to note that most respondents agreed with the proposals. In regards to the concerns raised, the Government can confirm that the trading and carry-over arrangements for 'crop' RTFCs will be the same as for other RTFCs, please see the response to question 36 for how rules on carry over will apply to 'crop' RTFCs. The Government's position in regards to the crop cap and energy crops has been detailed in the sections above. Having considered the responses and the evidence submitted, the Government concludes that 'crop' RTFCs are the most appropriate measure to introduce the crop cap and will proceed with this proposal.

2. Eligible fuels

Introduction

- 2.1 Chapter 2 of the consultation set out proposals aimed at adjusting the scope of the RTFO with regard to the fuels eligible for reward.
- 2.2 It was proposed to extend the scope of the RTFO to include renewable aviation fuels to support decarbonisation in the sector, and include non-biological renewable fuels, such as hydrogen, as the market for them develops.
- 2.3 In addition, changes were proposed to ensure that renewable fuels created from other renewable fuels that have already been rewarded by other Member States cannot subsequently receive RTFCs.

Including renewable aviation fuel in the RTFO

Consultation proposal

- 2.4 Aviation is a sector with limited options to decarbonise. The sector is pursuing a range of practical measures to enable sustainable growth without increasing carbon emissions. The UK supports the recent global agreement for a market-based measure at ICAO as the most effective way of addressing aviation emissions. However, other measures, including the use of renewable fuels, are required to address long term carbon reduction in this sector.
- 2.5 As a step towards encouraging the use of renewable fuels in aviation, we proposed to reward sustainable renewable aviation fuels under the RTFO. Suppliers would not be obligated to supply the fuel but would be able to claim RTFCs for eligible fuel. The fuel would be subject to the same sustainability criteria as other renewable fuels, and those which do not meet that sustainability criteria would not receive a reward and would be subject to an obligation under the RTFO.
- 2.6 Separately, we proposed to include aviation fuel made from appropriate wastes and residues in the new development fuels sub-target, where it would receive additional support (see Chapter one).

Question 16 – Do you agree that both renewable avtur and renewable avgas should be eligible for reward under the RTFO?

Summary of responses

Total	Yes	No	Not opposed
53	48	3	2

- 2.7 Forty-eight of the 53 respondents to this question agreed with the proposal to make renewable aviation fuel eligible for support in the RTFO. The 48 responses in support (and a further two who were not opposed to inclusion) consisted of three NGOs, seven fossil fuel suppliers/producers, 19 renewable fuel suppliers/producers, five from the aviation sector, a waste recycling company, as well as industry representative bodies from all sectors.
- 2.8 The key reasons for supporting the proposal were:
- The opportunity to reduce emissions in a sector that is hard to decarbonise;
 - Increased flexibility for obligated suppliers;
 - To help bridge the gap in cost between fossil and renewable fuel; and
 - To aid investment and development of UK industry in this area.
- 2.9 One respondent from the NGO sector and two from the renewables sector disagreed. The objections these respondents raised were:
- Without equal treatment with road transport fuel regarding taxation, the sector should not receive financial support for the use of renewable fuels;
 - Fossil aviation fuel is not included in the target set by the RED; and
 - That a separate international agreement would be more effective.
- 2.10 Many of those agreeing with our proposal nevertheless raised some concerns about how the proposal would be implemented and on longer term issues. These included:
- The fuel should only be produced from sustainable waste and residue feedstocks;
 - Support should reduce the price differential between fossil and renewable fuel and not act as a subsidy for fossil fuel;
 - The risk of double counting the emissions savings from fuels under different international schemes;
 - That the savings from international flights would not count towards carbon budgets until /unless the relevant clauses in the Climate Change Act were triggered;
 - That incentives for aviation biofuel should be part of a comprehensive strategy for limiting aviation emissions to 37.5 Mt by 2050;
 - That unsustainable renewable fuel should not be subject to the obligation as fossil fuel in the sector is not;
 - That future increases in volumes of this fuel would reduce demand for road transport fuels to meet the obligation and that the target should be adjusted to take account of this either now or when volumes of renewable aviation fuel increase; and
 - Renewable avgas should not be included due to the small size of the market.

Government response

- 2.11 The Government welcomes support for this proposal and sustainable renewable aviation fuels will be eligible for reward under the RTFO when the changes are implemented.
- 2.12 The Government's view is that only sustainable fuels should be rewarded and fuels will have to meet the same sustainability criteria as other fuels eligible under the RTFO. In addition, to receive rewards under the development fuels sub-target fuels will need to be made from sustainable eligible waste feedstocks.
- 2.13 The Government also agrees that support should reduce the cost of producing these fuels and put them on a more equal footing with fossil fuel. We do not anticipate the measure will subsidise fossil aviation fuel.
- 2.14 The Government agrees that a strategy is required to reduce emissions from the aviation sector and a coherent accounting framework is required to avoid double counting of emissions savings. The Government is working with our national and international partners to develop and implement policies to do so. As part of that the UK has been supporting an international agreement through the ICAO process, and this measure is consistent with that.
- 2.15 The Government will add any unsustainable renewable aviation fuels to the supplier's obligation to mitigate the risk of increased emissions from such fuels. This is consistent with the treatment of other unsustainable fuels and with wider policy measures to encourage the supply of the most sustainable fuels and reduce emissions.
- 2.16 We recognise concerns about the impact aviation fuels could have on suppliers of road transport fuels. However, we expect initial volumes of fuel to be very low and therefore the impact to be minimal in the near term. As with other aspects of the obligation, the Government will continue to keep this area under review to ensure the mechanism is meeting wider policy objectives.
- 2.17 The issue of taxation is beyond the scope of this consultation. We expect support via the RTFO to lead to investment by the aviation industry in the production of renewable aviation fuels and to directly contribute to decarbonisation.
- 2.18 Although the RED does not include energy used in aviation in the calculation of the target to be met by Member States, renewable fuels used in aviation are eligible to be counted towards meeting it. The RED proposals for 2030 include additional support for aviation fuels in recognition of the long term challenge to decarbonise this sector.

Setting an appropriate control point to account for renewable avtur

Consultation proposal

- 2.19 Under the current RTFO, the duty point (the time when duty of excise is payable) is used as the control point for all fuels. This control point is used to determine which fuels should be counted, when, and who owned them at the time of counting. Owners of eligible fuels at the control point can apply for RTFCs. Because avtur for

commercial purposes is not subject to fuel duty, we proposed to define an alternative to the duty point as the control point. For avtur used both commercially and privately, we proposed to use the point at which renewable fuels are blended into fossil avtur and certified to a relevant fuel standard.

Question 17 – Do you agree that the blending/certification point is a suitable control point for renewable avtur used for both commercial and private use?

Summary of responses

Total	Yes	No
35	24	11

- 2.20 Two thirds of respondents agreed with the proposal to use the certification point as the point of control for avtur reward under the RTFO.
- 2.21 Those supporting the proposal were a mix of industry representative bodies from different sectors and renewable fuel producers/suppliers. Comments in support included that it was suitable because:
 - The standard requires continuous monitoring of fuel quality from that point onwards and existing quality assurance processes require record keeping to track batches of fuel; and
 - The fuel can still be identified as a sustainable fuel at that point.
- 2.22 Eleven respondents who disagreed with the proposal comprised a mix of NGOs and fossil fuel suppliers/producers, including an industry representative body. Comments included:
 - Concerns it may make it hard to account for the associated emission reductions from the fuel under formal frameworks for carbon budgets and other international schemes, and a risk of double-counting the fuel;
 - That while a consistent control point was required it should have a separate internationally agreed policy and application;
 - The existing duty point for road transport fuel should be used to provide consistency across all fuel under the RTFO;
 - Certification does not require a third party and may occur outside of the UK; and
 - There may be further blending beyond the original blending/certification point.

Government response

- 2.23 The Government welcomes support for this proposal and will use the point at which renewable fuel is blended with fossil fuel and certified as the point at which owners of the fuel can claim reward.
- 2.24 In addition, although third party verification is not mandated by the fuel specifications at the blending point, the Government considers the requirements of the fuel specification regarding certification to be sufficiently robust for this purpose alongside the additional powers for the Administrator to verify claims for RTFCs.

2.25 This point is also suitable because, according to the fuel specifications, once a batch of blended fuel is certified no further blending of biofuel should take place, so the process should happen only once.

Alternative control point for renewable avtur

Consultation proposal

2.26 Following on from the previous question, this question asked if there was another control point for renewable avtur that we should consider in case the ‘certification point’ point was not deemed suitable.

Question 18 – Is there an alternative ‘control point’ which we should consider?

Summary of responses

Total	Yes	No
35	15	20

2.27 The majority of respondents did not think that there was an alternative control point to the one proposed (the point at which renewable aviation fuel is blended with fossil fuel). These included respondents from the renewable and fossil fuel sectors, including industry representative bodies.

2.28 Those that thought there is an alternative control point were from a mix of sectors including, NGOs, fossil fuel producers/suppliers, and industry representative bodies. Suggestions included:

- Placing it at the fuel farm level or at delivery to the airport would mitigate concerns regarding accounting for the emission savings mentioned at question 17;
- Using the dispatch point from bulk storage into the tanker at an airport would be better and similar to the duty point used for other fuels; and
- The “duty point” should be used for consistency across all fuels.

2.29 Despite supporting the proposal to use the blending/certification point the response from the aviation sector suggested an alternative could be the point of manufacture or import, if the fuel was imported as neat sustainable fuel.

2.30 Those that did not think that there is a suitable alternative to the blending/certification point were mainly renewable fuel producers/suppliers and industry representative bodies and suggested that using another point might place an additional burden on suppliers by further complicating the supply chain.

Government response

2.31 The Government notes the alternatives proposed, but agrees with the majority of stakeholders in that it does not consider them more suitable than the blending/certification point proposed in question 17.

- 2.32 The Government considers that the duty point as used for other fuels in the RTFO is not suitable for this purpose as the majority of aviation fuel is not taxed. As a consequence, the systems for checking and recordkeeping are not the same as for road fuels.
- 2.33 Using other points in the supply chain (i.e. after the biofuel has been blended with fossil fuel and certified) appears problematic as, once certified, the fuel is allowed to be treated as standard fossil jet fuel, thereby potentially lacking suitable records on renewable content. Rewarding neat sustainable fuel (prior to blending with fossil fuel) does not appear to be more suitable than the blending/certification point as it would not be certified as jet fuel at that point.
- 2.34 The Government will keep the suitability of the certification point under review to ensure it remains appropriate in the light of experience and developments with international methods, particularly the ICAO process.

Setting an appropriate control point to account for renewable avgas

Consultation proposal

- 2.35 Avgas, unlike avtur, is subject to fuel duty. Therefore we proposed to use the duty point as the control point for renewable avgas, in line with most other fuels under the RTFO.

Question 19 – Do you agree that the duty point is a suitable control point for renewable avgas?

Summary of responses

Total	Yes	No
30	29	1

- 2.36 All but one respondent agreed with the proposal, with support from all stakeholder groups with comments noting that the duty point was a proven control point.
- 2.37 While supporting the proposal, one respondent from the aviation sector noted that blending of renewable avgas is currently not permitted by the relevant fuel standards.
- 2.38 The respondent that disagreed suggested using a limited number of duty points at which the bio content is measured to mitigate the risk of multiple claiming of RTFCs.

Government response

- 2.39 Government welcomes support for this proposal and considers the risk of double claiming at this point to be no greater than for other fuels and mitigated by other measures in the Order. We will amend the Order to use the duty point for renewable avgas.

- 2.40 We recognise that currently there is no specification for renewable avgas but want to provide industry with the assurance that the fuel will be eligible when one is developed.
- 2.41 We consider that using a limited number of duty points is not practical and could complicate the operation of the RTFO.

Providing the Administrator with power to validate claims for reward for the supply of renewable avtur

Consultation proposal

- 2.42 An advantage of using the duty point as a control point for fuels in the RTFO is that the administrator is able to access Her Majesty's Revenue and Customs (HMRC) records to validate claims for reward. Since these are not available for avtur, an alternative method of validating renewable avtur volumes was proposed.
- 2.43 The industry is still developing and it is possible that direct examination by the Administrator of evidence held by industry on fuel supply may be feasible. However, as the number of applications increases it may be necessary to require independent assurance of the fuel volumes. It was therefore proposed that the Administrator would be given powers to do this as necessary.
- 2.44 It is envisaged that this independent assurance would be as similar as possible to the verification of sustainability information already required under the RTFO using the same standard, International Standard on Assurance Engagements (ISAE) 3000.

Question 20 – Do you agree that for renewable avtur, it is appropriate for the Administrator to require independent assurance of the volume of fuel when necessary?

Summary of responses

Total	Yes	No
39	30	9

- 2.45 The majority of respondents agreed with the proposal, noting that this is consistent with the approach taken with road transport fuel.
- 2.46 Of those supporting the proposal 20 respondents were from the renewables sector, including industry representative bodies. Comments included that:
- This was essential to prevent fraud and to ensure correct functioning of the market; and
 - Independent assurance should be required for the generation of RTFCs.
- 2.47 While NGO respondents agreed with the proposal, there was concern about ensuring there are safeguards to prevent double-counting of the emission savings across different reward schemes such as the EU Emission Trading Scheme and ICAO's Carbon Offsetting and Reduction Scheme for International Aviation.

- 2.48 An aviation sector respondent agreed but expressed concern that a standard should be consistent with the assurance needed for other regulatory systems to prevent administrative burdens being placed on other aviation fuel supply chains.
- 2.49 Of those opposed to the proposal eight were fossil fuel suppliers/producers and industry representative bodies. Comments included that:
- Duty point records could be amended to include renewable avtur;
 - The duty point would enable the Administrator to access HMRC records to validate fuel volumes; and
 - The process for adding the advanced fuel to avtur is similar to blending bioethanol and FAME and therefore should follow the normal certificate award process.

Government response

- 2.50 The Government welcomes the support expressed for this proposal, and will enable the Administrator to request independent verification of renewable avtur fuel volumes if required. This power is required to support accurate accounting of fuel volumes as there is not the same level of data as is available for fuels that are charged excise duty.

Setting an appropriate level of assurance for the validation of claims for renewable avtur

Consultation proposal

- 2.51 In order to provide the Administrator with the required level of assurance over the volumes supplied, and one that is comparable to the cross-checking of all volumes against HMRC data, we proposed that it is necessary to require the more detailed 'reasonable' assurance level provided for under ISAE 3000 for fuel volumes, rather than the 'limited' level which is used for renewable fuel sustainability information.

Question 21 – Do you agree that the requirement for a reasonable level of assurance, rather than the lower limited level of assurance, is appropriate for renewable avtur?

Summary of responses

Total	Yes	No
36	12	24 ⁴

- 2.52 The majority of respondents did not agree with this proposal, with most of those stating that a limited level of assurance should be sufficient, this includes the 11 organisations that did not answer the question but stated in response to question 20 that no more than limited assurance should be required for RTFCs.

⁴ Includes eleven respondents that did not respond but said that a limited level should apply in their response to Question 20.

- 2.53 Opposition to the proposal came from the renewable and fossil fuel sectors. Comments included that:
- The existing limited level was effective and should apply across all fuels;
 - Assurance to this level would be more difficult due to the complex nature of the supply chain; and
 - The increased amount of evidence required could potentially increase the time it takes to receive RTFCs and therefore negatively affect cash flow for small businesses.
- 2.54 Around one third of respondents supported the proposal and included all sectors, with responses from NGOs, renewable fuel suppliers/producers and the fossil fuel and aviation sectors. Comments included that it would:
- Involve minimal additional burden to the already complex supply chains; and
 - Help validate claims and ensure environmental integrity.
- 2.55 Though supportive, two respondents expressed concerns about avoiding imposing additional burdens by:
- Ensuring the requirement was clearly understood; and
 - Using existing regulatory systems for the fuel.

Government response

- 2.56 The Government notes the concerns expressed by stakeholders about the use of the higher, 'reasonable', level of assurance. It should be noted that this applies to the volume of fuel, not to verification of the sustainability of the fuel.
- 2.57 In the light of concerns expressed by stakeholders, the Government has decided to provide the Administrator with the discretion to require either a 'limited' or a 'reasonable' level of assurance for verifier's reports on the volume of fuel.
- 2.58 We note concerns raised by suppliers regarding the impact verification can have with regards to the time it takes for RTFCs to be issued, The intention is that the Administrator will be able to determine what is appropriate, considering the circumstances of each claim including other evidence provided, and keep under review the use of this power as experience and industry practice in this area develops.

Inclusion of non-biological renewable fuels, including hydrogen

Consultation proposal

- 2.59 We proposed to extend the scope of the RTFO to make renewable fuels of non-biological origin (RFNBOs) eligible for RTFCs. The benefits of including them are:
- RFNBOs can provide a contribution towards the UK's renewable energy target;
 - This contribution can be made sustainably given the potential for these fuels to deliver high GHG savings with a low risk of ILUC or competition with food;

- RFNBOs from eligible fuels can contribute to the proposed development fuels sub-target; and
- They can provide a means of utilising remote or constrained renewable electricity resources that would otherwise be too far from the grid or from demand.

2.60 Given that these fuels use novel processes and technologies, we considered that policy support is needed now to help bring them to market and encourage investment and further development.

2.61 We asked questions on how they should be defined, how to determine the proportion of fuel which is renewable, and whether they should meet the same sustainability criteria as biofuels. We also proposed a GHG calculation methodology and asked for input.

2.62 We asked some specific questions on renewable hydrogen related to the level of reward and how to determine and verify the volumes of fuel used in fuel cell electric vehicles (FCEVs).

2.63 We asked a question on how we might support low carbon fossil fuels beyond 2020.

Definition of renewable fuel of non-biological origin

Consultation proposal

2.64 Amendments to the RED by the ILUC Directive made a number of changes to how renewable fuels of non-biological origin (RFNBOs) are treated. ‘Renewable liquid and gaseous transport fuels of non-biological origin’ are now explicitly defined in both the RED Article 2(u) and the FQD Article 2(10) as: ‘liquid or gaseous fuels other than biofuels whose energy content comes from renewable energy sources other than biomass, and which are used in transport’. We proposed in our consultation to use this definition of RFNBOs in the Order.

Question 22 – Do you agree with applying the definition of non-biological renewable fuels used in the amended RED? If not, please provide an alternative and set out why.

Summary of responses

Total	Yes	No	Other
56	50	6	0

2.65 Fifty of the 56 respondents agreed with the proposed definition of RFNBOs. Four respondents from the oil industry supported this on the basis that these fuels are permitted by the amended RED and another respondent from the oil industry noted this would ensure a level playing field and harmonised EU renewable fuel market. A representative from the agricultural sector noted that harmonisation with EU standards was important both pre- and post-Brexit. A number of points were made regarding the definition and the policy as set out below.

Hydrogen as a means of harnessing excess renewable power

- 2.66 A hydrogen supplier supported the proposals as a way to avoid wasting renewable power (e.g. ~1 TWh p.a. in the UK, >4 TWh p.a. in Germany). They quote an Imperial College report from 2012 which indicates that such surpluses from the power system will approach 100TWh by 2050. They also note that as the grid decarbonises, greater volumes of low-carbon hydrogen can be produced.
- 2.67 One respondent supported the introduction of RFNBOs in principle, but felt that the cost of supplying the fuels would be prohibitive and that failures in the power grid would be more efficiently addressed by changing the regulatory framework for power and gas markets.

Concerns regarding multiple reward of the same renewable energy across sectors

- 2.68 Eleven stakeholders from the renewables and gaseous fuels sectors, including industry representative bodies, considered, however, that any renewable electricity (or heat) used to make a RFNBO should not receive support for both the electricity (or heat) e.g. from Renewables Obligation Certificates as well as support for the fuel (RTFCs) as this would be double rewarding the same renewable energy. Four of these respondents further noted that this would be consistent with the treatment of precursors whereby reward of the same renewable energy is not permitted across other renewable sectors or schemes (see question 12). A renewables sector representative body referred to their response to question 32 covering the need for sufficient verification and another noted that a reliable and transparent system is needed to avoid reward across multiple sectors.

Comments on the carbon source

- 2.69 One respondent noted that eliminating carbon monoxide may be difficult and questioned whether this would be a barrier to gas conversion technologies.
- 2.70 A local authority supported the development of the hydrogen economy but preferred a wider view of low carbon fuels to allow the exploitation of industrial carbon capture and storage.
- 2.71 Two respondents noted that RFNBOs can have a biological content. For example, if the source of carbon dioxide is biomass or hydrogen from biogas or gasified bio-feedstock.
- 2.72 An academic disagreed with the definition on the basis that it could be confusing to refer to 'waste carbon dioxide', as carbon dioxide is a 'gaseous effluent emitted to atmosphere', and therefore is excluded from the scope of the Waste Framework Directive 2008/98/EC Article 2, 1(a). They did, though, support the principle of not deliberately generating the carbon dioxide.

Comments on the renewable energy input

- 2.73 One renewable fuels supplier felt that waste heat from non-renewable sources should be considered as renewable. They noted that this is more energy efficient than using renewable energy in electrolysis.

- 2.74 A local authority felt there was an opportunity to use by-product heat and gas streams as well as other low carbon energy such as nuclear.
- 2.75 One supplier who disagreed with the proposed definition responded that the exclusion of electricity from biological sources would be problematic and unreasonable. They acknowledged however, that including electricity from biological sources would not conform with the RED.

Concerns that biological hydrogen is excluded

- 2.76 Another respondent from the hydrogen sector considered that the RTFO should support any form of renewable hydrogen, not just non-biological due to their GHG and air quality benefits.

Concerns that low carbon fossil fuels are excluded

- 2.77 A respondent from the hydrogen sector noted that fossil derived hydrogen provides significant GHG and air quality benefits.
- 2.78 Two respondents from the aviation sector and related industries supported the definition but were disappointed that industrial waste carbon monoxide was excluded. They note that the policy is based on current definitions of renewability and that some bodies include biodegradation of industrial waste as renewable. Another option would be to include fuels that are a result of carbon capture and utilisation (CCU). They note that whilst fuels produced from such sources are proposed to be included in RED II post-2020, they need certainty now for the investment to occur. Excluding such fuels was considered contradictory to the intent of the RTFO.
- 2.79 An NGO disagreed on the basis that some fossil fuels produced using advanced technologies may bring GHG benefits e.g. hydrogen from natural gas combined with carbon capture and storage or aviation fuel from industrial waste gas. They suggested that if a proportion of the process ran on renewable energy the resultant fuel might be classified as renewable. They suggested that if a solution to support these fuels in the RTFO could not be found then support should be increased in the GHG Regulations (see the parallel consultation).

Government response

- 2.80 The Government recognises the role these novel fuels can make towards decarbonising transport and making use of surplus renewable energy that might otherwise be wasted. Given the widespread support for this proposal we will widen support under the RTFO to include RFNBOs and will apply the definition of RFNBOs set out in the consultation.

Clarification of a number of points raised by stakeholders

- 2.81 Regarding the source of the carbon: note that the definition sets out that the energy content comes from renewable sources other than biomass. This does not preclude the carbon dioxide from being derived from biomass as this carbon dioxide will not impart any energy content to the final fuel. If an alternative carbon source is used, such as carbon monoxide derived from biomass (which does impart biological energy to the fuel), then the resultant fuel would be a biofuel (or part RFNBO, part biofuel if

carbon dioxide plus carbon monoxide were used). These fuels would therefore be eligible for support under the RTFO. Note that, in line with other biofuels, the biomass would need to be sustainable and evidence would need to be provided to demonstrate that it had met the land criteria (i.e. that no loss of biodiversity or destruction of carbon stocks had occurred).

- 2.82 Where a fuel is made from a mixture of fossil carbon monoxide and carbon dioxide, the resultant fuel would be part RFBNO, part fossil fuel. Only the renewable portion of the fuel will be eligible for reward.
- 2.83 Regarding the use of 'waste' carbon dioxide – we note that gaseous fuels are excluded from the Waste Framework Directive. As such the requirement in our legislation will be that the inputs have not been deliberately produced for the sole purpose of creating a RFNBO.
- 2.84 There was some confusion that this definition does not cover biological hydrogen and it might therefore be precluded from support under the RTFO. To clarify, biological hydrogen is already eligible for support under the RTFO (and also see question 29 regarding bringing renewable hydrogen for FCEVs into scope). As such, the introduction of this definition of RFNBOs widens support to other renewable forms of hydrogen i.e. the inclusion of RFNBOs in the RTFO does not limit support to renewable non-biological hydrogen.
- 2.85 Regarding electricity (or heat) from biological sources we will not include reward for fuels produced from renewable and biological energy sources for the following reasons:
- We wish to encourage novel fuels from non-land using sources;
 - Further support for biomass risks direct and indirect land use change. Applying full sustainability criteria, including the land criteria, might be difficult to trace and verify. Whilst biomass used in the UK grid is subject to sustainability checks, other countries may not apply sustainability criteria; and
 - Any fuels produced from biomass derived electricity or heat would not count towards our renewable energy targets and would be inconsistent with its treatment across the EU.
- 2.86 We note the responses advocating the use of fuels from waste industrial gases, waste heat from non-renewable sources, or fossil hydrogen and agree that these present an alternative option for decarbonising transport. However, these are not renewable fuels so would not be captured by the RFNBO definition. A full response on the opportunity for low carbon fossil fuels is provided under question 23 and fossil hydrogen is addressed under question 28.
- 2.87 Consideration of points raised regarding reward of both the renewable electricity (or heat) and the resultant fuel are provided under question 24.

Support for low carbon fossil fuels under the RTFO

Consultation proposal

- 2.88 Beyond 2020 the consultation proposed that low carbon renewable fuels would continue to be supported through the RTFO. However, we are also interested in the potential of low carbon fossil fuels to decarbonise transport beyond 2020. The

consultation sought views on how they might be supported, which fuels, feedstocks and/or technologies should be encouraged, and if the RTFO is the right mechanism.

Question 23 – How might low carbon fossil fuels be supported beyond 2020, which fuels, feedstocks and/or technologies should be encouraged, and is the RTFO the right mechanism?

Summary of responses

Total	Comments
42	42

- 2.89 Respondents recognised the success of the RTFO in delivering renewable transport fuels, increasing greenhouse gas savings and influencing UK transport policy. Many stated that investors require a growth environment, policy consistency, double counting for waste and demand beyond existing blends.
- 2.90 Nineteen respondents suggested incentives be proportional to greenhouse gas savings (rather than based on feedstock) and without mandating their use. This would be a technology neutral way forward beyond 2020. It was suggested that low carbon fossil fuels should be included in multiple counting to incentivise quality rather than quantity. Another suggestion was for independent validation against the fossil fuel being superseded to determine the level of incentive and objective assessment of available global technologies and potential reductions.
- 2.91 There were suggestions to support thermal processes, waste gasification, hydrogen, municipal solid waste, power to gas plants, carbon capture and utilisation from wastes, and less advanced fuels like biomethane.
- 2.92 Respondents recognised that low carbon fossil fuels providing verified carbon reductions could be encouraged, but with reviews to ensure value for money and that support is not at the expense of a growing supply chain for more beneficial fuels.
- 2.93 There were also a range of suggestions not relevant to low carbon fossil fuels, such as support for fuels made from Annex IX feedstocks.
- 2.94 Outside of support through the RTFO, suggestions included:
 - Removing the liquid petroleum gas fuel duty escalator;
 - Duty derogations set as long-term policies (e.g. five or more years, preferably 10);
 - Tax exemptions for fuels;
 - Encouraging private sector investment, establishing scale so industry can compete without ongoing public sector support;
 - Access to capital funding (for research, development, low cost loans, advanced biofuel plants, innovation funds, incentives for consumers purchasing fuels and vehicles, vehicle conversions, infrastructure and digital innovation); and
 - Five respondents said fossil fuels should not be incentivised as they are not low carbon, renewable or sustainable. A renewable fuel supplier suggested low carbon fossil fuels should be encouraged but not included in the RTFO.

Government response

- 2.95 The Government welcomes these suggestions from stakeholders as to how low carbon fossil fuels might be supported beyond 2020 and which fuels, feedstocks and/or technologies should be encouraged. Government notes that respondents were largely in favour of a technology neutral approach to low carbon fossil fuels going forward and recognises that these fuels are still at an early point in their technology development and as such that it is too soon to pick winners in this arena.
- 2.96 The Government is pleased that our stakeholders recognised the success of the RTFO in delivering renewable transport fuels and increasing greenhouse gas savings and as such will continue to explore the RTFO as an appropriate mechanism through which to support low carbon fossil fuels.
- 2.97 The European Commission has proposed to include low carbon fossil fuels in the RED after 2020. However, there is not as yet a methodology in place for lifecycle analysis to calculate carbon emissions reductions compared to conventional fossil fuels. The Government's next steps therefore are for further investigation, and collaboration with the Commission, to ensure that carbon emissions reductions can be quantified and verified so the UK is in a position to support low carbon fossil fuels offering cost effective carbon emission reductions in the coming years.
- 2.98 In the meantime, DfT has launched the Future Fuels for Flight and Freight Competition (F4C). The Competition, which will provide £22m of matched capital funding to support the construction of low carbon aviation and HGV fuel production facilities, is open to bids from low carbon fossil fuel projects.

Determining how much of the fuel is renewable

Consultation proposal

- 2.99 All of the energy content in a RFNBO is derived from the process energy which therefore must be renewable (and not derived from biomass). Where the process energy is partially renewable, e.g. electricity drawn from the grid, then the resulting fuel will be partially a RFNBO, with the remainder treated as fossil fuel.
- 2.100 We proposed that where the renewable electricity used to produce the fuel is not connected to the grid, or where the production facility is not drawing energy from the grid (e.g. is a net exporter to the grid) then the renewability of the final fuel should similarly reflect the renewability of the electricity, e.g. 100% renewable fuel if the electricity is wholly renewable (but not from biomass).
- 2.101 Similar principles would apply should the renewable energy input be renewable heat or cooling.

Question 24 – Do you agree with the proposed approach for determining how much of the fuel is a renewable fuel of non-biological origin?

Summary of responses

Total	Yes	No	Other
50	44	6	0

2.102 The majority of respondents supported the proposal including stakeholders from the renewable and fossil sectors as well as a number of industry representatives.

2.103 Points raised by those who supported the methodology were:

- Other zero carbon sources e.g. waste heat should be eligible for support;
- If green certificates become eligible in future it is essential that they are only counted towards one scheme to avoid multiple claiming of the same unit of green electricity;
- The phrase "net exporter to the grid" needs to be defined in terms of time i.e. whether it is per hour, per day, per month, or per year; and
- Determining the amount of fuel that is renewable should be undertaken in a transparent and robust manner to ensure there is no "cheating", but, in the case of power to gas and SNG production it must also recognise the need for grid synchronisation, back-up power and emergency generation.

2.104 In addition, a stakeholder highlighted four ways that electricity can be supplied for the production of RFNBOs, but considered that the consultation only recognised the fourth of these:

- 1 **Dedicated/private wire connection to a renewable power source e.g. wind farm or hydro station.** The facility producing the RFNBO will be connected to the power network, but will use electricity from the renewable energy site when in production. There is likely to be some bleed through onto the power network, particularly if there is provision for community energy. Output from the RFNBO production site would be 100% renewable.
- 2 **Power purchase agreement with a dedicated renewable energy facility e.g. wind farm connected to the local distribution network and the RFBNO facility connected at a different point on the same distribution network.** In such an arrangement, output from the wind farm would match production/electricity demand in the RFBNO production site. Provided there was a match between RFBNO production and renewable energy output (which would be simple to show with real-time metering) there is no reason why output could not be classed as 100% renewable.
- 3 **Purchase agreement with a supplier to only provide green electricity to a power to gas system.**
- 4 **General electricity purchasing with a proportion of renewable based generation.**

2.105 Those that disagreed with our proposed methodology for determining renewable content either wanted more flexibility or greater restrictions.

2.106 Points in favour of a greater restriction in determining the renewable content and reward received were as follows:

- Double claiming of the renewable energy should be avoided across multiple sectors e.g. transport and power, to be consistent with the treatment of biofuels;
- Only the renewable electricity that is additional should be rewarded to ensure that renewable electricity is not diverted from other uses;

- RFNBOs will create extra demand and therefore where facilities are grid connected the marginal energy type (poorest performing for GHG purposes e.g. coal) should be considered rather than the average;

2.107 Points cited in support of more flexibility were:

- The actual renewable split should be determined on a daily basis to represent the real life situation;
- Renewable biomass should be included – clarity was also requested on whether this would count as a biofuel and be eligible for RTFCs;
- The use of green certificates or guarantees of origin for electricity should be permitted;
- The ability of electrolytic hydrogen production to absorb excess energy and provide grid operator with balancing services should be taken into account and allocated a significantly above average renewable content.

Government response

2.108 In our consultation we set out that grid averages for renewable electricity could be used in determining how much of a fuel is a RFNBO. In this approach, that renewable electricity will have been eligible for support under renewable electricity schemes (and the resultant fuel would be eligible for RTFCs). The Government notes the concerns regarding allowing reward to be applied across multiple sectors (whether electricity, heat or transport). However, we also note that, on the contrary, a number of stakeholders wanted greater flexibility, such as allowing ‘green certificates’ to count as evidence of supply of renewable electricity.

2.109 On balance, we consider that the approach set out in the consultation is appropriate as these novel fuels are expensive and need support to get to market. Nonetheless we will keep the approach under review as the market develops. Both in terms of whether support is permitted to be claimed under multiple sectors and also whether ‘green certificates’ or purchase agreements for renewable electricity (or heat) are permitted.

2.110 Further detail on what is acceptable to be counted as a net exporter to the grid will be set out in guidance.

2.111 Where waste heat is from a renewable source it will be eligible to produce a RFNBO; however, fossil sources are not currently eligible under the RTFO. See question 23 for further information on low carbon fossil fuels.

Ensuring renewable fuels of non-biological origin are sustainable

Consultation proposal

2.112 To ensure consistency with other renewable fuels and the objectives of the scheme to reduce GHG emissions from transport, we proposed that RFNBOs meet the same minimum GHG saving threshold as biofuels. However, as they are typically non-land using we did not propose to apply the land criteria.

Question 25 – Do you agree that renewable fuels of non-biological origin should meet the same sustainability criteria (apart from the land criteria) as biofuels?

Summary of responses

Total	Yes	No	Other
56	55	1	0

- 2.113 All bar one of the 56 respondents agreed that RFNBOs should meet the same minimum GHG savings as biofuels in order to be supported under the RTFO.
- 2.114 Comments included that there should be consistency with the RED, consistency across all renewables, and, that it is important that both consumers and authorities are confident that fuels that are being supported are sustainable. One fuel supplier considered that sustainability and GHG reduction potential should be central to assessing support under the RTFO and that it should not be based on feedstock or technology.
- 2.115 One fuel supplier noted that in the future a higher proportion of grid electricity will be generated from renewable sources than today and so the policy should not inhibit early adoption of synthetic fuels.
- 2.116 Three stakeholders in the renewables sector felt that there may be a case for adding sustainability criteria with respect to water use in the future. An NGO agreed but felt that sustainability criteria should be strengthened for all renewable fuels, citing the Roundtable on Sustainable Biofuels as an example. Another NGO felt that we should go further and apply land criteria to RFNBOs as wind, solar and other renewable technologies can all use land and impact the natural environment.
- 2.117 The fuel supplier who disagreed felt that non-recyclable plastics would not generate the same GHG reductions and that the reward could be adjusted to reflect this difference.
- 2.118 A fossil fuel supplier questioned how unsustainable RFNBOs would be added to a supplier’s obligation – they supported adding unsustainable renewable fuels to a supplier’s obligation where that fuel is usually obligated, but not where it is aviation fuel.

Government response

- 2.119 There was strong support for applying sustainability criteria. We will proceed with applying the same GHG criteria to RFNBOs as applies to biofuels in order to ensure that RFNBOs are sustainable and that all renewable fuels are treated consistently.
- 2.120 Impacts on land use for renewable technologies should be addressed at the planning stage so we do not consider it necessary to introduce any further requirements here. However, we will monitor sustainability impacts – including both land and water use – and keep sustainability requirements under review.
- 2.121 Fuel made from non-recyclable plastics would not be classed as a RFNBO – see response to question 23.

2.122 Any fuel that is unsustainable – in line with biofuels – will be added to a suppliers obligation in the case of fuel used for road transport, non-road mobile machinery or aviation. This is to encourage the supply of sustainable fuels.

Proposed greenhouse gas calculation methodology

Consultation proposal

2.123 In the consultation we proposed a GHG calculation methodology for RFNBOs to be included in the RTFO. This was adapted from Annex V of the RED (which sets out the GHG emissions calculation methodology for biofuels). Note that this methodology was proposed to apply to RFNBOs, but also be flexible enough to consider other non-renewable, but low carbon fuels, that might be added to the RTFO at a later date.

Question 26 – Do you agree that the GHG calculation methodology should align with the RED, where possible, for consistency with biofuels?

Summary of responses

Total	Yes	No	Other
57	56	0	1

- 2.124 Fifty-six of the 57 stakeholders who responded to this question agreed that we should align the GHG calculation methodology with the RED where possible.
- 2.125 Comments included that this was practical, would enhance consistency, support a level playing field and foster consumer confidence. A consultant pointed in particular to support for the rules which set out that producers may use the emissions value for the production plant where it is not connected to the electricity grid.
- 2.126 An NGO considered that the methodology should not necessarily be aligned with the RED, but the outcome should be comparable.
- 2.127 Two stakeholders related to the aviation industry noted that the rules should also apply to fuels derived from carbon monoxide or carbon capture and utilisation, in line with their responses to earlier questions.
- 2.128 One stakeholder took the opportunity to comment that default factors in the RED should be updated and gave the example for biomethane which should include more feedstocks and pathways and should also reflect more recent [JRC-CONCAWE Well to Wheel Analysis published in 2014](#). Another supplier felt that avoided emissions from landfill should be credited to biomethane.

Government response

2.129 We will proceed with requiring the use of the GHG calculation methodology as set out in the consultation. There will be a further opportunity to comment on this as part of the consultation on the RTFO Guidance.

2.130 Biomethane defaults are set by the European Commission and so are outside the scope of this consultation. We would encourage stakeholders to engage directly with the Commission with regards to making any updates.

Question 27 – Do you have any other comments on the GHG calculation methodology?

Summary of responses

Total	Yes	No	Other
27	10	17	0

2.131 Ten stakeholders submitted further comments on the GHG calculation methodology. A number repeated comments which were submitted to earlier questions and are described in the summaries to questions 22–26 above.

2.132 One fuel supplier would like guarantees of origin to be accepted as they would act to increase the supply of renewable electricity.

2.133 A fossil fuel supplier questioned why the following terms were removed:

- eCCR = emission saving from carbon capture and replacement;
- eL = annualised emissions from carbon stock changes caused by land-use change; and
- eSCA = emissions saving from soil carbon accumulation via improved agricultural management.

2.134 Three stakeholders from the renewables sector stated that paragraph 2.55 in the consultation document makes little sense and that expressing values in terms of gCO₂eq/MJ represents an ‘absolute’ value, only dependant on the methodology set, whereas expressing values in terms of km/MJ introduces uncertainties incompatible with legislative purposes (dependant on the vehicle used, the methodology for efficiency calculation). Paragraphs 2.54–2.55 from the consultation are repeated here for ease of reference:

“[para 2.54] Greenhouse gas emissions from fuels, E, shall be expressed in terms of grams of CO₂ equivalent per MJ of fuel, gCO₂eq/MJ.

[Para 2.55] By derogation from point 2.54, for transport fuels, values calculated in terms of gCO₂eq/MJ may be adjusted to take into account differences between fuels in useful work done, expressed in terms of km/MJ. Such adjustments shall be made only where evidence of the differences in useful work done is provided.”

2.135 The same stakeholders also stated that the higher fossil fuel baseline set in the FQD should be used rather than the fossil fuel comparator for determining GHG emissions savings of biofuels.

2.136 An NGO noted that whilst CCU from industry (e.g. steel mills) to develop aviation fuel could be beneficial for both sector’s efforts to de-carbonise, CCU only delays the release of GHG emissions to the atmosphere. They flagged paragraph 2.60 of the consultation which sets out that the individual tonnes of industrial GHG emissions avoided must therefore be counted and claimed only once – in this example, either

by the industrial site, the aircraft operator, or shared across both entities. Multiple counting across various sectors would result in the failure to achieve overall climate change objectives under the Paris Agreement.

Government response

- 2.137 The terms used in the biofuel lifecycle analysis which have been removed are not relevant to calculating GHG emissions for RFNBOs. The latter two are related to land using crops. The first point on carbon capture and replacement (CCR) is not necessary as allowing a credit for CCR would overstate the GHG emissions saved.
- 2.138 Para 2.55 of the consultation was included for parity with biofuels due to inclusion in the RED. However, we acknowledge that it is not necessary for determining GHG savings for RFNBOs and we will remove it.
- 2.139 The baseline GHG emissions in the FQD represents the 2010 fuel mix and is used for determining GHG savings relevant to suppliers' GHG reduction targets. The fossil fuel comparator in the RED and FQD is used for determining GHG savings for biofuels for sustainability purposes (i.e. whether they meet the minimum GHG savings thresholds) and is therefore more appropriate for applying to RFNBOs under the RTFO. This will determine if RFNBOs meet these minimum sustainability requirements to enable a level playing field for all renewable fuels.
- 2.140 We agree that multiple claiming across sectors should generally be avoided – see response to questions 23 (low carbon fossil fuels), 17 (aviation) and 32 (precursors).
- 2.141 How to determine the renewable proportion of the fuel is covered in question 24.

Support for hydrogen

- 2.142 Renewable hydrogen can play a strategic role in contributing to the decarbonisation of transport and we are keen that renewable hydrogen suppliers are able to participate in, and capture value from, the RTFO.
- 2.143 We proposed to amend the RTFO to support hydrogen through:
- Aligning the treatment of renewable hydrogen with other gaseous fuels (this will include both bio-hydrogen and non-bio renewable hydrogen, i.e. a type of RFNBO). This will involve setting the number of RTFCs for which 1kg of renewable hydrogen is eligible to reflect its energy content;
 - Ensuring that hydrogen supplied for FCEVs is eligible and can be properly accounted for; and
 - Including hydrogen in the development fuels sub-target.
- 2.144 This section of the consultation sought views on our proposed reward for renewable hydrogen and our recommended control point to reward hydrogen. Furthermore, we asked for views on introducing independent assurance (verification) for hydrogen fuel volumes where the fuel is not subject to duty. Finally we asked for opinions on requiring a 'reasonable' level of assurance for hydrogen fuel volumes.

Setting the level of reward for renewable hydrogen

Consultation proposal

- 2.145 We proposed to support hydrogen under the RTFO and to align the treatment of renewable hydrogen with other gaseous fuels (this will include both bio-hydrogen and non-bio renewable hydrogen, i.e. a type of RFNBO). To achieve this we proposed to employ an RTFC multiplier of 4.58 when calculating the appropriate reward for hydrogen, to reflect the fact that 1 kg of hydrogen contains 4.58 times as much energy as an average litre of liquid biofuel.
- 2.146 This is consistent with previous amendments in 2015 to the RTFO Order which increased the rewards for biomethane and bio-liquefied petroleum gas (bio-LPG) to reflect their higher energy content relative to liquid biofuels.

Question 28 – Do you agree with the proposed level of reward for renewable hydrogen – 4.58 RTFCs per kg?

Summary of responses

Total	Yes	No	Other
33	26	7	0

- 2.147 Ten fossil fuel suppliers and two related industry representative bodies agreed with this proposal, along with three-quarters of respondents from the renewable fuels sector. Two hydrogen suppliers and one industry representative body opposed our proposal on the basis that it does not go far enough in supporting hydrogen. Three renewable fuel suppliers and one respondent from the farming sector also disagreed with the approach.
- 2.148 Fossil fuel suppliers were of the opinion that all fuels should compete on the same basis, and underlined that the methodology to calculate the level of support for hydrogen should be transparent and consistent with that applied to other fuels. In addition, they said that the energy source used for hydrogen generation should be renewable and any by-products should also be considered in determining the carbon impact. However, five of these fossil fuel suppliers also highlighted that only a whole number of RTFCs should be awarded, and that the decimal point should be rounded as appropriate.
- 2.149 Ten renewable fuel stakeholders also agreed with the proposal, although with the caveat, for almost half of these respondents, that for gaseous fuels the level of reward is calculated on an energy basis.
- 2.150 One respondent from the energy sector noted that hydrogen has a higher energy content by weight, but has a lower energy content than natural gas by volume. Also that when setting the level of reward the cost of filling and storing hydrogen in vehicles should be considered as well.
- 2.151 Three respondents also affirmed that only 'renewable' hydrogen should be rewarded, highlighting development processes and sources employed for its production. One renewable fuel supplier suggested that the label 'renewable hydrogen' should be re-expressed as 'renewable hydrogen or renewable hydrogen-derived fuels'.

- 2.152 Another renewable fuel supplier affirmed that hydrogen should be considered renewable only if it was guaranteed that the electricity employed to produce it was renewable.
- 2.153 Finally, one NGO agreed with our proposal provided that the hydrogen is renewable and is used for aviation, freight and/or shipping.
- 2.154 Reasons provided by respondents who disagreed with the proposal wanted a greater level of reward for the following reasons:
- Hydrogen is more efficient than hydrocarbons and therefore the number of RTFCs should be higher; and
 - Hydrogen as a development fuel needs greater market confidence to represent a profitable opportunity to attract investment, and the Government proposal is not sufficient.
- 2.155 Regarding the first point, hydrogen suppliers noted that gasoline engines are 20% less efficient than fuel cells in converting chemical energy into power that moves the vehicle. Moreover, fuel cells use 40% to 60% of the fuel energy, corresponding to more than a 50% reduction in fuel consumption, compared to gasoline internal combustion engines. These respondents therefore recommended to incentivise efficiency gains by increasing the proposed level of reward for hydrogen by a factor of 2-3 times (9.16 – 13.74 RTFCs per kg).
- 2.156 Regarding the second point, a renewable supplier noted that the level of award in terms of the number of certificates would also depend on the buy-out price.
- 2.157 Among the other points raised, a consultancy recommended the Government ensures that the correct conversion is used, as hydrogen can be supplied at differing volumetric energy contents depending on the pressure (350 bar, 700 bar, or liquid product).
- 2.158 Finally another respondent from the farming sector did not agree with the proposed level of reward as they did not believe that using hydrogen as fuel is either efficient or economically viable.

Government response

- 2.159 The Government is pleased that a majority of respondents supported our approach and, having carefully considered the consultation responses, it confirms the adoption of the proposed level of reward for renewable hydrogen as outlined in the consultation document.
- 2.160 The proposed methodology to reward hydrogen is consistent with that adopted with the 2015 amendments to the RTFO Order. These amendments increased the rewards for biomethane and bio-LPG to reflect their higher energy content relative to liquid biofuels.
- 2.161 The number of RTFCs awarded will be rounded to the nearest whole number once the multiplier has been applied.
- 2.162 Only renewable hydrogen, either of biological or non-biological origin, will be eligible for RTFCs, but not fossil hydrogen, in line with other fuels. The different classifications of hydrogen are:
- Biofuel – if produced from biological materials;

- RFNBO – if produced from non-biological materials but using renewable energy; and
 - Fossil fuel – if produced from fossil energy, or materials. If produced from biological energy the hydrogen will also be treated as fossil hydrogen.
- 2.163 One stakeholder advised that, in calculating the rewards, the Administrator should take into consideration that hydrogen can be supplied at differing pressure levels. However, the RTFO reward system works on a weight basis for gaseous fuels, which means that *n* kilograms of hydrogen will always contain the same amount of energy regardless of the pressure at which they are supplied.
- 2.164 Concerning the suggestion that the Administrator should consider the cost of filling and storing hydrogen in vehicles when setting the reward, the Government clarifies that supply chain costs cannot be used to calculate the reward to renewable fuels as this would not be consistent with the treatment of other fuels under the RTFO.
- 2.165 Most renewable hydrogen will be eligible for development fuel RTFCs, which we anticipate are likely to achieve a higher value in the market than other conventional RTFCs. Please see the calculation below reflecting the maximum possible reward:
- 80p (buy-out price) x 2 (double counting) x 4.58 (RTFC hydrogen multiplier) = £7.33 per kilogram of renewable hydrogen supplied.*
- 2.166 Concerning the opportunity to foster market confidence, the Government highlights that its support for hydrogen goes beyond these amendments to the RTFO. The Government has committed £4.8 million to support the installation of 12 publically accessible hydrogen refuelling stations (HRS), bringing the total number of HRS in the UK up to 15.
- 2.167 Supporting these stations are 50 FCEVs, the purchase and operation of which are 75% funded by an additional £2 million FCEV fleet support scheme competition from the Government, launched in May 2016.⁵

The ‘control point’ for renewable hydrogen

Consultation proposal

- 2.168 We proposed amending the RTFO to ensure hydrogen supplied for FCEVs is eligible for RTFCs and can be properly accounted for. As there is no duty point for this fuel we proposed to use the point at which hydrogen is sold to a retail customer as an alternative control point. This means that the supplier of hydrogen is eligible to claim RTFCs, and that they will have to provide evidence to the Administrator that this has been sold for the appropriate use (e.g. sales invoices).

Question 29 – Do you agree that the point at which renewable hydrogen is sold to a retail customer for use in a fuel cell vehicle is an appropriate ‘control point’ for this fuel?

⁵ The competition winners are listed at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/560406/fuel-cell-electric-vehicle-fleet-support-scheme-winners.csv/preview

Summary of responses

Total	Yes	No	Other
37	24	13	0

- 2.169 Around two thirds of respondents supported our proposal. Among them, 13 renewable fuel suppliers and three related industry associations, two fossil fuel suppliers and one related industry representative body, one gas supplier, one waste recycling company, one fuel storage company, one academic respondent, and one hydrogen supplier.
- 2.170 However, another hydrogen supplier did not support our proposal, alongside a hydrogen representative body. Also, six fossil fuel suppliers did not agree, alongside two associated industry representative bodies, one renewable supplier, one consultancy and another industry representative body.

Support for the proposed control point

- 2.171 Three respondents from the renewables sector affirmed that using the point of retail sale seems appropriate given the differing sources of hydrogen as well as their respective supply chain length differences. One hydrogen supplier supporting our proposal commented that the point at which renewable hydrogen is sold to a retail customer is the juncture at which the consumer is most interested in. This respondent also affirmed that electricity can be metered at the filling station to enable the monitoring of the energy and GHG footprint of the hydrogen.

Concerns regarding the proposed control point

- 2.172 Those from the fossil fuel sector thought it was better to ensure consistency in the reporting system for renewable fuels instead of creating new, separate systems. For instance, fuels like biomethane, do not enjoy a separate system.
- 2.173 One renewable fuel supplier argued that, overall, using too restrictive a definition may result in the benefit of the RTFC being given to the vehicle operator rather than the fuel producer.
- 2.174 A hydrogen supplier and a related industry representative association suggested that the definition of 'sold to a retail customer for use in a fuel cell vehicle' could limit the success of hydrogen under the RTFC scheme. This is because hydrogen is not only used by retail customers, but also during the course of business. Furthermore, hydrogen is also used in internal combustion engines. Therefore they recommend that the control point for hydrogen should instead be the point where hydrogen is dispensed at the nozzle for use in any vehicle or application where a fossil fuel is displaced.

Alternative control points proposed

- 2.175 A fossil fuel supplier proposed that the 'deemed' duty point for hydrogen should be the point at which it exits the gate of the manufacturing or importing facility, to be consistent with other fuels.

2.176 A renewable fuel industry association also suggested that an additional control point could be the point at which the fuel is sold to a biorefinery for the purpose of transformation into a renewable fuel which qualifies for RTFCs.

Other points raised

2.177 A renewable fuel supplier, who agreed in principle with the proposal, was of the opinion that the promotion of fuel cell drivetrains should be supported through other measures and the RTFO should not be used for this purpose.

2.178 Another fossil fuel supplier concluded that if FCEVs gain significant market penetration, the Government should look at recovering declining petrol and diesel duty revenue by applying duty to hydrogen fuel. For the moment, a consultancy recommended that the Treasury introduces a small, symbolic fuel duty rate of £0.05/kg which, while having 'zero impact' on pump prices, would ensure that renewable hydrogen is recorded at the duty point. This would also avoid limiting hydrogen's potential for growth without treating it differently to all other fuels.

Government response

2.179 Following consideration of the responses received from stakeholders, the Government confirms its proposal concerning an alternative control point for hydrogen. Two thirds of respondents agreed that this is the most effective approach to reward hydrogen in the absence of a duty point because the point of sale is where hydrogen is 'set aside' as a motor fuel, and can only happen once (which will aid compliance and reduce the risk of fraud). No suitable alternatives were proposed.

2.180 Our proposal means that suppliers of hydrogen in FCEVs will be eligible to claim RTFCs, and that they will need to provide evidence to the Administrator that this has been sold for the appropriate use (e.g. sales invoices).

2.181 We consider that employing flexible, i.e. variable, control points would cause inconsistencies in monitoring hydrogen fuel volumes, making it difficult, costly, and not comparable to the more consistent monitoring carried out for other fuels.

2.182 Furthermore, adopting control points located upstream in the supply chain may increase the scope for fraud, including misreporting, as it would be more challenging for the Administrator to determine if the hydrogen will be used as a road fuel. We therefore believe that the most efficient control point for hydrogen is the point of retail for use in a FCEV.

2.183 Clarification on the other points raised by stakeholders is set out below.

2.184 There was some confusion on the definition of the control point, in particular regarding the expression 'retail customers'. This was considered too narrow by some respondents. To clarify, 'retail customers' means also business customers and not only private passenger vehicles.

2.185 Concerning the FCEVs, we consider the adoption of FCEVs as functional to the long-term strategic role which renewable hydrogen will increasingly play for the decarbonisation of transport.

2.186 The Government notes suggestions to apply a fuel duty rates to hydrogen, however this is a matter for Treasury. Liquid hydrogen used in conventional combustion engines is already dutiable at the road fuel rate.

Introducing independent assurance (verification) for hydrogen fuel volumes where the fuel is not subject to duty

Consultation proposal

2.187 One of the advantages of using the duty point as a control point for fuels in the RTFO is that the Administrator is able to access HMRC records to validate the amounts of fuel which have been reported. Since these records do not exist for hydrogen used in FCEVs, an alternative method of validating the amount of hydrogen will be required. Whilst the industry is still developing, it is possible that direct examination by the Administrator of evidence held by industry applicants may be feasible. However, it may be necessary to require independent assurance (verification) of the amount of fuel. We therefore proposed to give powers to the Administrator to do this.

Question 30 – Do you agree that the proposed powers for the Administrator are sufficient to ensure the independent verification of the amounts of fuels which are not subject to duty of excise?

Summary of responses

Total	Yes	No	Other
28	27	1	0

- 2.188 All bar one of those who replied to this consultation question agreed with our proposal.
- 2.189 Five fossil fuel suppliers and one of their related industry representative bodies affirmed that the Administrator will need evidence that the hydrogen had been added to the fuel. However, the process for adding advanced fuel should be similar to the current practice, using the principle of a duty point. In addition, all fuels including electricity used in vehicles and hydrogen should be subject to duty even if that duty rate is set initially at zero. As specified by one fossil fuel supplier, adopting a consistent system is the only way to ensure robust and full reporting, aligned with how avtur is currently treated.
- 2.190 As already set out in response to question 29, a consultancy (the only negative response) recommended that, instead of introducing new powers to the Administrator, the Treasury introduces a small, symbolic fuel duty rate.

Government response

- 2.191 The Government noted that almost all respondents agreed with the proposed powers to the Administrator, and therefore will proceed as per the consultation proposal.
- 2.192 Concerning the suggestions to adopt a fuel duty rate for hydrogen, please see our response to question 29.

Requiring the 'reasonable' assurance level for hydrogen fuel volumes

Consultation proposal

2.193 As part of our proposal to give powers to the Administrator to require independent assurance (verification) where necessary, we proposed to adopt, the more detailed 'reasonable' assurance level provided for under ISAE 3000 for hydrogen fuel volumes, rather than the 'limited' level which is used for renewable fuel sustainability information. This would provide the Administrator with the required level of assurance over the volumes supplied, and one that is comparable to the cross-checking of all volumes against HMRC data (which is only possible for fuels upon which duty is payable).

Question 31 – Do you agree that the requirement for a reasonable level of assurance, rather than the lower limited level of assurance, is appropriate?

Summary of responses

Total	Yes	No	Other
28	20	8	0

- 2.194 More than two thirds of respondents agreed that reasonable assurance was required to verify hydrogen fuel volumes. This included 12 renewable fuel suppliers, two of their related industry representative bodies, and one hydrogen supplier. Two fossil fuel suppliers and one of their industry representative bodes also agreed that this is a reasonable approach for renewable hydrogen, as no duty point exists.
- 2.195 Six fossil fuel suppliers and one of their industry representative bodies disagreed with the proposal. These respondents thought that the same level of limited assurance should continue to apply to all parts of the RTFO without discretion. They affirmed that any increase to the limited level of assurance should only be implemented through changes to internationally recognised voluntary schemes. One of these respondents noted that, with regards to the RED II, the Commission already recognises that it is appropriate to strengthen the future role of voluntary schemes.
- 2.196 Finally, one consultancy disagreed with this proposal, suggesting the introduction of a symbolic duty rate.

Government response

- 2.197 The majority of respondents supported our proposal to adopt the reasonable level of assurance provided for under ISAE 3000 for fuel volumes, which is comparable to the cross-checking of all volumes against HMRC data.
- 2.198 We will provide the Administrator with the power to request independent assurance if considered necessary and will have discretion as to which level should apply, either 'limited' or 'reasonable'.

- 2.199 Information provided under voluntary schemes relates to sustainability data for which a limited level of assurance is more appropriate. However, the reasonable level of assurance is comparable to the cross-checking of all volumes against HMRC data. This will be in addition to the independent assurance for sustainability information.
- 2.200 Finally, concerning the suggestions to adopt a fuel duty rate for hydrogen, please see the Government response to question 29.

Preventing double reward for the same energy

Question 32 – Do you agree with the proposal to prevent the claiming of RTFCs for fuels created by a precursor that has been rewarded under another renewable energy scheme?

- 2.201 We proposed to expand the current restriction that RTFCs cannot be claimed where the fuel has been supported under another renewable energy scheme within the European Economic Area (EEA) to include where a precursor of the fuel has been supported.

Summary of responses

Total	Yes	No	Other
44	40	3	1

- 2.202 The proposal was supported by forty of the forty-three respondents comprising: fourteen renewable fuel suppliers, six fossil fuel suppliers, five industry representative bodies, three NGOs, three consultancies, two academic organisations and one organisation from each of the energy, hydrogen supply, renewable fuel production/supply and renewable gas supply sectors as well as an independent advisory body. Two fossil fuel and one renewable fuel supplier disagreed with our proposal.
- 2.203 One renewable fuel supplier who did not indicate whether they agreed or disagreed with the proposal commented that we should seek the views of UK market operators.
- 2.204 Thirteen respondents (eight renewable fuel suppliers, two industry representative bodies, one fossil gas supplier, one renewable gas supplier and a consultancy) wanted the proposal to be extended to include renewable energy support schemes outside of the EEA, with blending support in the USA being specifically mentioned.
- 2.205 Eleven respondents discussed potential fairness issues raised by whether or not this proposal should also apply to electricity used to produce RFNBOs (e.g. hydrogen) or to power electric vehicles. Of these, eleven respondents (two consultants, one renewable fuel supplier and one energy sector body) recommended that we should ensure that there is no multiple subsidy for electricity used for these purposes. Conversely, four renewable fuel suppliers, an academic and a fossil gas supplier recommended that multiple subsidies be allowed whilst the RFNBO and electric vehicle markets are in an early stage of development. One renewable fuel supplier recommended that 100% renewable electricity input for RFNBO production

(where that electricity is subsidised) should be excluded whilst grid average renewability electricity should be included.

- 2.206 Five fossil fuel suppliers and one industry representative body recommended that this issue be dealt with in the same manner in all EU countries and that the onus of proof should be put upon the renewable fuel producer.
- 2.207 One renewable fuel supplier submitted a detailed argument which they claim demonstrates that the example of Dutch origin biomethane to methanol does not result in multiple counting of the same energy under two different countries renewable energy obligations.
- 2.208 One renewable fuel supplier recommended that we ensure that the use of any fuel eligible to count towards both the RTFO and the Greenhouse Gas Regulations target is not covered by this proposal.
- 2.209 Of the three respondents that disagreed with our proposal, a renewable fuel supplier provided no further comment, a fossil fuel supplier supported the generic principle but not the specific proposal as they considered that the matter should be dealt with by the voluntary schemes. A second fossil fuel supplier, whilst also supporting the generic concept of no double-counting did not support this specific proposal because they had a number of concerns including: that the matter should be dealt with by voluntary schemes; that the onus of proof should not be upon the obligated parties; that there should be a similarity of approach towards electricity; and that we should not include any agricultural wastes or residues that are being supported under energy crop production subsidies.

Government response

- 2.210 Having considered the points raised and the significant amount of support for the proposal, we intend to proceed with this change.
- 2.211 We have consulted with the Dutch Emissions Authority regarding the detailed argument raised by one respondent with regards to the example quoted in the consultation document. The Dutch Emissions Authority have confirmed that our understanding of the overlap between methane being counted towards the Dutch overall renewable energy target under the RED and the methanol being counted by ourselves towards our overall RED target is correct.
- 2.212 We have considered whether it would be possible to include countries outside of the EEA. Whilst we regard this as a desirable policy aim, we have been unable to identify a suitable legislative mechanism to attach the prohibition to. As such, to introduce such a prohibition as a stand-alone concept within the RTFO Order would create both a significant burden upon the Administrator to define which overseas schemes are covered as well as potential uncertainty for suppliers. We will therefore be keeping the prohibition upon EEA member states only as these apply a common accounting approach to ensure that renewable energy is only claimed once under the RED. We will keep this matter under review, including the desirability of referencing the EEA following Brexit.
- 2.213 We recognise the need to ensure that this mechanism is workable in practice and will both provide further guidance and will work with voluntary schemes to encourage them to adopt systems that ensure that this prohibition is covered by them.

Views on preferred solution to preventing multiple claiming

Consultation proposal

2.214 We asked respondents for their opinion upon two options to extend the restrictions regarding reward under more than one scheme. These were to either (1) to have a limited restriction upon 'chemical precursors for fuels or (2) to have a more generic restriction upon 'energy contained within' the fuel.

Question 33 – Do you have any opinion as to whether either of the two options considered would be preferable and whether either would have unintended consequences?

Summary of responses

Total	Limited restriction	Generic restriction	Support but no opinion on which option	Disagree
12	1	8	2	1

2.215 All bar one of the eleven respondents provided opinions that were supportive of the proposal.

2.216 Of these, one renewable fuel supplier supported the 'chemical precursor' approach due to the ease of creating a definition.

2.217 Of the seven respondents that supported a generic approach, three are renewable fuel suppliers, two are academics and one each an industry representative body, waste recycling company and fossil fuel supplier. Of these, three renewable fuel suppliers all indicated that measures should be taken to avoid conflicts with renewable electricity support mechanisms. One renewable fuel supplier and one fossil fuel supplier supported the proposal but provided no opinion as to which option they preferred.

2.218 One fossil fuel supplier disagreed with the proposed approach. A detailed argument had been provided under question 32 as to why this was the case.

Government response

2.219 Having considered the responses under these two questions, and in the questions relating to RFNBOs we have decided to adopt the tighter definition which prohibits chemical precursors. As the RED allows for electricity to be counted in a number of ways⁶, this approach is in keeping with the RED.

⁶ including at the point it is generated towards the overall target, at the point of use in road and rail towards the transport target and as 'grid average' towards the determination of both the renewability of RFNBOs and the carbon intensity of biofuels

3. Changes to sustainability requirements

Introduction

- 3.1 Chapter 3 of the consultation set out a number of mandatory changes to the sustainability requirements in the RTFO. These are required by [EU Regulation 1307/2014](#) and the recent amendments to the RED to introduce a number of changes to a range of sustainability requirements. They were included to provide suppliers with time to prepare for the changes.
- 3.2 The changes required by EU Regulation 1307/2014 and the RED are:
- Changes to when reporting of default carbon intensity values is permitted;
 - Inclusion of the definition of highly biodiverse grasslands set by EU regulation 1307/2014;
 - Changes to the definitions of new and old installations and changes to the deadlines for meeting the minimum greenhouse gas savings; and
 - Additional reporting requirements for the ILUC emissions of food crops.

Change to requirements on when default values can be reported

Consultation proposal

- 3.3 The ILUC Directive amended the conditions under which the carbon defaults in RED Annex V can be reported. We intend to amend the RTFO to transpose this.
- 3.4 Suppliers are required to report on the associated carbon intensity of the biofuels they supply. The default carbon intensity values provided in Annex V of the RED are split into three component parts (or 'disaggregated defaults') involved in the creation of the biofuel, these are:
- Cultivation of the feedstock;
 - Emissions from processing the feedstock into fuel; and
 - Transport (of the feedstock and/or fuel).
- 3.5 Currently, the defaults can only be used where biofuels fall into one of the following three categories:
- a. Cultivated outside the EU;
 - b. Cultivated in regions in the EU where the cultivation emissions from the relevant biofuel feedstock are below the disaggregated default for cultivation; or
 - c. Made from wastes/residues.

- 3.6 The EU regions referred to in (b) are standardised EU regions for the collection of data known as Nomenclature of Territorial Units for Statistics 2 (NUTS2) level. The NUTS2 regions where the carbon default can be reported (NUTS2 compliant regions) were determined by reports submitted by each Member State. These reports (known as 'NUTS2 reports') modelled the GHG emissions from cultivation for different biofuel feedstocks by region.
- 3.7 Amendments to the RED Article 19(3) remove this restriction and allow the relevant default to be reported for all types of biofuel, whether they are EU or non-EU crops or derived from wastes/residues.
- 3.8 We therefore intend to remove this restriction from the RTFO by removing paragraphs 5(2)(b), all of 5(3) and 6(4), and the definition of 'low emission zone' from the Schedule.
- 3.9 Note that suppliers will still be permitted to use the UK NUTS2 report data as a source of actual cultivation data as set out in the RTFO Guidance.

Defining highly biodiverse grassland

Consultation proposal

- 3.10 We proposed updating the sustainability criteria in the RTFO Order to include highly biodiverse grassland in the land criteria for biofuels. The land criteria sets out where biofuels cannot be grown if they are to count towards renewable energy targets, or be eligible under national support schemes.

GHG threshold changing dates

Consultation proposal

- 3.11 We proposed to amend the definitions of new and old chain installations in the RTFO Order and the corresponding minimum greenhouse gas savings which must be delivered by biofuels to transpose amendments made to the RED.
- 3.12 This is necessary to ensure that minimum GHG savings thresholds achieved by biofuels eligible for reward under the RTFO, and counted towards the UK's renewable energy targets, align with the minimum GHG savings thresholds set by the ILUC Directive.

Government response

- 3.13 We intend to proceed with the changes set out in this chapter as they are required by the amended RED and by EU Regulation 1307/2014.

4. Operational changes

Introduction

Consultation proposals

- 4.1 In Chapter 4 of the consultation the Government proposed a number of operational changes to the RTFO to ensure and demonstrate that the UK meets its obligations under the RED and the FQD. Specifically the proposed operational changes were to:
- Amend the RTFO obligation period so that it runs on a calendar year basis;
 - Prohibit the carry-over of Renewable Transport Fuel Certificates (RTFCs) from the 2019 into 2020 but allow up to 25% of a supplier's obligation in 2021 to be met from RTFCs carried out of either 2019 or 2020; and
 - Amend the specific duty to keep the obligation level under review in order to ensure the requirements in the RED are met.
- 4.2 With these policy aims in mind the Government sought views on the following:
- Any unintended consequences of moving to a calendar year (question 34);
 - Whether to proceed with prohibiting the carry-over of RTFCs into 2020 (defined as option 4) or other alternatives, including those listed below, (questions 35 and 36); and
 - Whether to remove the specific duty to review the obligation level to ensure we meet the RED 2020 targets (question 37).
- 4.3 The responses to these questions are summarised below.

Moving to a calendar obligation year

Question 34 – Do you think there will be any negative consequences as a result of changing the RTFO obligation period to a calendar year?

Summary of responses

Total	Yes	No	Other
38	0	38	0

- 4.4 Those who responded to the proposal considered it sensible to move the RTFO obligation period to a calendar year and that doing so will likely generate only very minor administrative changes for suppliers. However, this was with the caveat that the in-year RTFO reporting periods (monthly for larger suppliers) should remain in

line with mid-month HMRC reporting dates. Given this, some suppliers asserted that an obligation year should run from 15 January to 14 January.

Government response

- 4.5 The Government will proceed with proposals to move the RTFO to a calendar year (i.e. 1 January to 31 December) and align the reporting periods under the RTFO with those in the Motor Fuel Greenhouse Gas Reporting Regulations. Subject to parliamentary approval this will mean a short year in 2018 and the first full calendar year will start from 1 January 2019. It should be noted that this will mean changes to certain reporting deadlines as set out in illustrative examples in the consultation document.
- 4.6 It is also important to note that a consequence of a short obligation year ending on 31 December 2018 would be that the total volume of fuel required to meet the obligation would be lower in that obligation period, and therefore the total number of RTFCs that could be carried over to meet the obligation in 2019 would also be lower. The carry over percentage would continue to be 25% of a supplier's obligation in the short obligation year.
- 4.7 In implementing these changes, we intended to minimise the administrative burden on suppliers. In order to do so we will continue with our approach of aligning suppliers reporting under the RTFO with the relevant HMRC reporting periods. The change to a calendar year will remove the need for small, usually biofuel only, suppliers (operating on the HMRC HO930 system) to split calendar months/quarters. However, it will mean that the larger fossil and biofuel suppliers (who operate on the HMRC HO10 system) will be required to split the mid-December to mid-January supply period in order to match the calendar year timings of the RTFO. No other supply periods will need to be split.
- 4.8 The RTFO Administrator will retain its discretionary power enabling it to require reporting from suppliers on different time periods depending on how they report to HMRC. The Administrator will update its guidance to reflect this change and will continue to take a pragmatic approach to mismatches between RTFO and HMRC reporting periods. This includes accepting a '50:50' split of fuel volumes (where a HMRC reporting period falls across two RTFO reporting periods) and where there is no reason to suspect another split has occurred.

Changes to the carry-over of RTFCs into 2020

Consultation proposal

- 4.9 The consultation set out a range of options for changes to the carry-over of RTFCs in 2020. Our preferred approach was option 4, which was to prohibit the carry-over of RTFCs from 2019 into 2020, but allow a supplier to carry-over from 2019 into 2021 instead. RTFCs from both 2019 and 2020 could be carried over into 2021 but the carry-over limit of 25% of a supplier's obligation would remain in place. We asked two questions about this issue and provide a single combined Government response below.

Question 35 – Do you agree with the proposal in option 4 to prohibit the carry-over of RTFCs into 2020, and also allow RTFCs from 2019 to be carried over into 2021?

Summary of responses

Total	Yes	No	Other
36	27	9	0

- 4.10 The majority of respondents agreed with the proposal to prohibit the carry-over of RTFCs into 2020. Those in agreement included a fossil fuel industry representative body, a fossil fuel supplier, respondents from the gaseous fuel and electricity sectors and the vast majority of respondents from the renewable fuel sector and their representative body.
- 4.11 In supporting the proposal to restrict carry over, respondents agreed it will ensure that the RED target in 2020 is met and ensure, as far as possible, normal RTFC purchasing patterns by allowing RTFCs from both 2019 and 2020 to be carried over into 2021.
- 4.12 However, in offering support for the restrictions proposed on carry-over, respondents from the renewable fuel sector noted that if carry-over were to remain at 25%, and all development fuels are issued with double certificates, then the UK risks losing out on reductions in GHG emissions. This group also suggested that a high carry-over also does not allow for seasonal uncertainties in biofuel supply chains and that biofuels investors would benefit from a lower carry-over.
- 4.13 Conversely, those who disagreed with the proposed restrictions on carry over, predominantly fossil fuel suppliers and their industry representative body, argued that such a restriction could increase costs and affect RTFC trading. In arguing against the proposal they suggested that compliance with the 2020 target will be challenging and that as the decarbonisation of transport is not coming to an abrupt end after 2020, by implication, there will be a market for RTFCs beyond 2020.

Alternative options to option 4

- 4.14 Alternative proposals to option 4 presented in the consultation paper were:
 - Option 0 - no change, with carry over permitted as it is now and the obligation reaching 9.75% in 2020;
 - Option 1 - carry over permitted as it is now, but the obligation is increased by either a further 15% or 25%;
 - Option 2 - reduce carry-over into 2020 from 25% to 15% and increase the obligation by a further 15% in 2020; and
 - Option 3 - no carry-over into 2020, and no carry over out of 2019.

Question 36 – Do you prefer any of the other options in Table 9 [of the consultation and set out above], or have alternative suggestions?

Summary of responses

Total	Yes	No	Other
32	14	18	0

- 4.15 We received 14 responses supporting alternative options to the restriction on carry-over proposed in option 4.
- 4.16 One electricity provider expressed a preference for option 1, to retain the carry-over as now but increase the 2020 obligation level of 9.75% by either a further 15% or 25%.
- 4.17 The remaining responses for alternative options were split by supplier type. Fossil fuel suppliers and their industry representative body preferred Option 0 with no change to carry-over, but noted that, of the other options, the Government's proposed restriction on carry-over in option 4 was preferred. Two fossil fuel suppliers suggested that option 4 could be improved by increasing the total cap on carry-over into 2021 from 25% to 50%. In expressing this view they suggested an increase would prevent a risk of oversupply in 2020 which might otherwise affect the value of RTFCs.
- 4.18 A gaseous fuel supplier and those representing renewable fuel suppliers, whilst expressing a preference for option 4, suggested that carry-over should actually be reduced to either 20% or 10%, with a review of that level post-2020.
- 4.19 Unrelated to carry-over, one renewable fuel supplier questioned why the Government was removing the recycling of buy-out under the RTFO. This supplier suggested that the proposals in the consultation overall increased the risk of buy-out which would mean that GHG savings would not be achieved and any buy-out received would effectively be a tax.

Government response

- 4.20 The Government believes that increasing the carry over limit to 50% would not deliver our policy objectives, which include minimising disruption to the RTFC market. We also note that under the RTFO suppliers have met an average of 16% of their obligation through the use of carry-over - this is significantly below the current limit of 25% which we therefore intend to maintain.
- 4.21 Note that the 25% limit will apply to all types of RTFC i.e. including RTFCs issued to development fuel and to crop-derived biofuel.
- 4.22 This means that (as is currently the case) suppliers can meet up to 25% of their main obligation by redeeming RTFCs carried forward from the previous obligation period. These RTFCs can have been issued to any type of biofuel including crops or development fuels. However, RTFCs issued to crop-derived biofuel from the preceding obligation period must not exceed 25% of the relevant crop cap.
- 4.23 As set out in our response to question three, suppliers will also need to meet a new development fuel sub-target. The 25% carry over limit will apply separately to the main obligation and the development fuels sub-target
- 4.24 The Government needs to mitigate the risk of insufficient renewable fuel being supplied in 2020 in order for the UK to meet the Renewable Energy Directive target of 10% renewable energy in transport. We will therefore proceed with the proposal in option 4 of the consultation and prohibit the carry-over of RTFCs from 2019 into

2020, but provide obligated suppliers with flexibility by allowing carry-over from 2019 into 2021 instead. This will mean that RTFCs from both 2019 and 2020 could be carried over into 2021. It will also mean that in 2021 up to 25% of a supplier's main obligation and development fuel sub-target could be met through redeeming RTFCs carried over into that year (as well as up to 25% of the crop cap permitted to be met with RTFCs carried into that year).

- 4.25 In fulfilling our better regulation duties to review the legislation, one aspect to consider will be the impact of introducing these new carry-over provisions. In monitoring whether the limits on carry-over are effective in both providing obligated suppliers with flexibility in meeting the renewable transport fuels obligation and supporting the right market for greenhouse gas reductions.
- 4.26 Regarding removal of the recycling of the buyout – we intend to proceed with this as we anticipate that suppliers' commercial and financial plans will not be negatively affected by the removal of buy-out recycling. As set out in the consultation we understand that the option to buy-out under the RTFO has not been exercised to date on a commercial basis and removing the recycling of the buy-out fund will ensure the UK's obligation to supply biofuel under the RTFO is consistent with EU state aid rules.
- 4.27 Subject to parliamentary approval of our proposed amendments to the RTFO there will be no recycling of monies paid into any buy-out fund arising from the current obligation year 2017/18 or subsequent obligation years.

Duty to review the obligation level to ensure we meet the RED 2020 targets

Question 37 – Do you agree that the specific duty to review the obligation level to ensure we meet the RED 2020 targets for transport is no longer required and should be removed?

Summary of responses

Total	Yes	No	Other
46	30	16	0

- 4.28 Whilst about two thirds of those who responded were in favour of the proposal to remove the specific duty to review the RTFO to ensure we meet RED 2020 targets, there was some misunderstanding that the proposal would mean that there would be no wider duty to keep the RTFO under review.
- 4.29 Of those supporting the proposal and providing comments, most were fossil fuel suppliers and their representative body, who suggested the Government should review whether targets in the RTFO were achievable post-Brexit.
- 4.30 Others providing comments in support – including consultants, representatives of the agricultural industry and an NGO – and those opposed to the proposal, identified the areas where a specific review provision might be useful. Areas identified were to:

- Hold the Government to account in respect of the Climate Change Act and carbon budgets;
- Deliver on the commitment in the consultation document to keep the obligation level under review and raise it if required;
- Meet requirements for a five year review more generally;
- Account for new fuels, in particular, development fuels;
- Review the trading price of development fuel certificates; and
- Review the impact of the crop cap, particularly on buy-out.

Government response

- 4.31 We are grateful for suggestions from respondents as to what areas future reviews of the RTFO might cover. In addition to those areas listed immediately above the wider consultation has identified other changes to the RTFO which the Government should keep under review. These include:
- Fuels that should qualify as development fuels and what the ‘assurance level’ should be for these;
 - The criteria for renewable fuels from non-biological origin which would be eligible for reward under the RTFO and how GHG emissions reductions would be calculated for such fuels; and
 - A range of further policy suggestions for the future when the UK leaves (these are covered in more detail in the response to question 38).
- 4.32 The measures outlined in the Government’s response will help transport meet its share of the carbon budget reductions. They are also intended to offer UK industry the long term certainty it needs to invest and to take advantage of the growing global advanced fuels market. Leaving the EU is not expected to have a material effect on the direction of the policy outlined.
- 4.33 The Climate Change Act 2008 already requires us to set legally-binding carbon budgets which cap the amount of greenhouse gases emitted in the UK over a five-year period. The carbon budgets are designed to set a cost-effective route to achieving the UK’s long-term climate objectives. The first five carbon budgets have been put into legislation and will run up to 2032, and the Committee on Climate Change advises on the appropriate level of each carbon budget.
- 4.34 The Committee on Climate Change’s advice suggests that the main opportunities for reducing transport emissions through the 2020s will be more efficient conventional vehicles; increased penetration of electric and plug-in hybrid vehicles; and biofuels. Given that we will need liquid and gaseous transport fuels for decades to come, increasing the supply of renewable transport fuels would make a significant contribution to meeting UK carbon budgets 4 (2023-27) and 5 (2028-32).
- 4.35 We recognise the importance that electric vehicles have in reducing emissions from road transport. As set out in the UK [plan for tackling roadside nitrogen dioxide concentrations](#), the Government’s ambition for Britain to lead the world in electric vehicle technology and use is central to its objective of tackling emissions of both nitrogen oxides and carbon dioxide. We are investing £1bn in the development, manufacture and use of ultra-low emission vehicles, and are committed to ensuring that almost every car and van on the road is a zero emission vehicle by 2050.

- 4.36 The Government does not believe that it is necessary to put specific review provisions in the RTFO Order 2007 stating that the Secretary of State must assess whether targets are achievable post-Brexit, or to specifically review the RTFO in the context of Climate Change Act 2008. As is the case now, the Government will continue to keep under review whether a larger contribution from the RTFO presents a cost effective means of delivering our climate change commitments compared to other options as part of the carbon budget process. The change to align the RTFO targets to carbon budget periods further supports this review process.
- 4.37 As set out in the consultation, whilst we will be removing those provisions which place a specific duty to review the obligation level to ensure we meet the RED 2020 targets, we will retain a general requirement to keep the RTFO under review. This will ensure a periodic review of the RTFO in line with better regulation best practice. It will also ensure that the Government addresses the bulk of the areas respondents have suggested form part of future reviews, whilst avoiding inadvertently restricting the scope of future reviews, undermining investor certainty or duplicating requirements placed on Government in other legislation such as under the Climate Change Act.

5. Civil penalties

Introduction

- 5.1 Chapter 5 of the consultation outlined the proposed changes to extend the powers of the Administrator to issue civil penalties to take account of the new sub-target obligation and newly eligible fuels.

Minor changes to the Administrator's civil penalty powers

Consultation proposal

- 5.2 We proposed to extend the Administrator's power to issue civil penalty notices in the Order under the following circumstances:
- Instances where a supplier fails to discharge their new obligations in respect of the sub-target for development fuels; and
 - Where a supplier has failed to ensure that information and evidence provided is accurate in respect of new fuels which we propose should be eligible for reward under the RTFO.
- 5.3 The purpose of these amendments is to ensure effective enforcement of the RTFO scheme. The changes were not included in the proposals being consulted on. They were set out for information only, to enable suppliers and producers time to prepare for the introduction of the changes to the operation of the civil penalties regime.

Government response

- 5.4 We intend to proceed with these proposals.

6. Further potential for low carbon transport fuels

Introduction

- 6.1 Chapter 6 of the consultation sought views on the opportunities for low carbon transport fuels policy associated with leaving the EU, as well as ways to increase the use of biofuels in freight including:
- The potential for biofuel use in HGVs;
 - Identifying the barriers to increased use of biofuels in heavy good vehicles and Government’s role in addressing them; and
 - How to increase the deployment of biofuels in freight cost effectively.

Leaving the European Union

Consultation proposal

- 6.2 As the UK’s decision to leave the EU provides an opportunity to look afresh at the UK policy on low carbon fuels, the consultation sought views on how low carbon transport could be supported outside the EU in the future.

Question 38 – When we leave the EU, what further opportunities should we consider to develop our low carbon transport fuels policy framework and related policies?

Summary of responses

Total	Comments
48	48

- 6.3 Forty-eight respondents provided comments to this question with a wide range of proposals relating to both the general policy framework and more fuel/feedstock specific measures. The majority of respondents asked the Government to at least maintain the current level of ambition for low carbon fuels, with most respondents recommending to raise the ambition further. Many respondents urged the Government to keep the current framework broadly in place (or replace it with according UK measures), in particular, in relation to research and infrastructure

funding as well as EU-wide fuel efficiency, sustainability and greenhouse gas savings criteria.

6.4 Individual responses also highlighted specific opportunities the EU exit could provide to the UK. These included:

- quicker state aid decisions;
- removal of current import tariffs on waste;
- consistent treatment of lignocellulosic material across sectors; and
- the opportunity to take a leading role in advanced biofuels.

6.5 Respondents suggested the following changes to the current policy:

- Increase RTFO targets;
- move the current RTFO to a system rewarding fuels on the basis of their GHG emission savings;
- Develop further the existing measures and accounting rules to ensure the sustainability of fuels, and to make emissions savings more visible to consumers (e.g. through fuel duties);
- Improve access to funding for research and first-of-a-kind plants, maintain access to current EU funding or match funding accordingly, and continue with Advanced Biofuels Demonstration Competitions;
- Take further measures to support the development of infrastructure and maintain or match current EU infrastructure funding;
- Encourage higher blends (e.g. B100, E10, E15, E20, E85) and petrol hybrids;
- Focus on heavy duty vehicles, including measures to incentivise a speedier fleet renewal (e.g. scrappage schemes);
- Continue close cooperation with the EU (for example on sustainability criteria, fuel efficiency standards) and make use of opportunities for joint projects; make greenhouse gas savings part of international trade agreements and support for developing countries;
- Keep the trade for waste open, not allowing for import tariffs or technical barriers, and address concerns as regards to potential tariff barriers for crops in relation to the crop cap and the domestic bioethanol industry;
- Include low carbon, non-renewable fuels among the eligible fuels and do more for specific fuels (e.g. biomethane, biomethanol, biopropane or hydrogen);
- Ensure a level playing field for electric vehicles, do not focus only on biofuels and explore synergies between the transport and electricity sector (e.g. in relation to hybrid systems);
- Introduce the concept of 'low indirect land use change risk' biofuels;
- Include aviation emissions in the UK carbon budget;
- Ensure fuel costs remain competitive;
- Improve waste collection; and
- Exclude non-road mobile machinery from the RTFO.

Government response

- 6.6 The Government welcomes the suggestions and proposals made by respondents. As set out in response to question 37, leaving the EU is not expected to have a material effect on the direction of the policy. However, we will take the proposed changes into consideration for any future policy development and will maintain the dialogue with stakeholders on these matters, for example, as part of regular stakeholder workshops.

Exploring the UK biofuel potential for heavy goods vehicles

Consultation proposal

- 6.7 In addition to the proposed changes to the Order, the consultation sought views on ways in which transport can be decarbonised more widely, particularly for modes that are challenging to electrify, notably road freight and aviation. Chapter 6 asked a number of questions related to this issue, including the potential for biofuel use in freight. A combined response to these is provided below.

Question 39 – What is the potential in the UK for the use of biofuels (waste derived biomethane and biodiesel etc.) as fuels for HGVs?

Summary of responses

Total	Comments
50	50

- 6.8 Respondents were largely positive recognising strong potential in market-ready fuel blends and biomethane and identifying potential in emerging technologies.
- 6.9 Twenty respondents recognised that B20 and B30 blends are readily available and offer high potential in HGVs and buses. An industry representative body and renewable fuel supplier stated that there is good potential for deployment of these fuels in HGVs over 33 tonnes, as they have high levels of fuel consumption. Respondents stressed that incentives are needed for B100 and blends greater than B90, suggestions included providing support through a sub-target.
- 6.10 Fifteen respondents stated that biomethane is readily available, offering strong potential and five quoted the Renewable Energy Association study on biomethane availability figure of 83 TWh/yr, with some suggesting this could be exceeded by including advanced thermal processes for treating wastes. Suggestions included support so biomethane is priced comparably to fossil gas and diesel, and prioritised for HGVs and buses.
- 6.11 Respondents also recognised potential, with the right support, for:
- Fatty-acid-methyl-esters and hydrotreated vegetable oil;
 - RFNBOs such as hydrogen;
 - SNG;
 - Renewable or low carbon methanol;

- Biopropane;
 - Advanced biofuels, particularly drop-in replacements;
 - Emerging technologies such as high ethanol and methanol blend fuels like ED95 or MD95 for use in converted diesel engines;
 - Gasification or Fischer-Tropsch to contribute to diesel or jet fuel requirements (agricultural residues and waste feedstocks could contribute); and
 - Technologies producing aviation fuel which produce a drop-in product that can be blended to diesel at high levels.
- 6.12 An NGO said that Government should analyse the total waste available to UK industry in the forthcoming bio-economy strategy and assign waste across sectors. A renewable fuel supplier suggested that waste stream advanced biofuels could be used for HGVs but that they would need support to overcome capital costs to commercialise and upscale the technology.
- 6.13 A consultancy suggested the current potential renewable fuel supply is low, limited by the high cost of drop-in replacements and low numbers of alternatively fuelled vehicles.
- 6.14 A fossil fuel supplier said that, in terms of reducing transport emissions, fuel economy measures are more important than advanced biofuels. They suggested that legislation, improved infrastructure and reduced congestion can achieve sufficient emission reductions.

Barriers to wider deployment of biofuels in the HGV sector

Consultation proposal

- 6.15 The Department is considering ways in which transport can be decarbonised. The most cost effective route to deploy biofuels is through low level blends in mainstream fuel. There may be benefits to using higher renewable blends in HGVs. The Department is seeking to understand the key barriers to wider biofuel deployment in HGVs.

Question 40 – What are the key barriers to wider deployment of biofuels in the HGV sector?

Summary of responses

Total	Comments
46	46

- 6.16 The key barrier highlighted by respondents was cost. Respondents noted that uncertainty regarding fuel duty incentives and RTFO support, as well as increased vehicle and infrastructure costs, have affected the uptake of biofuels in HGVs. Fuels identified as hindered by these barriers were hydrotreated vegetable oil, fatty-acid-methyl-esters, biomethane, used cooking oil, power to gas, synthetic natural gas and biopropane.

- 6.17 Twelve respondents identified infrastructure barriers, which would require legislation and funding to resolve. In particular:
- Most infrastructure is restricted to only supply a single grade of diesel;
 - The high cost of technology for truck and refuelling infrastructure;
 - Efficient and secure access to the fuel is needed to minimise refuelling journeys;
 - The UK gas network should be utilised, offering significant well to tank savings;
 - Biomethane needs to be supplied through conveniently located, reliable and low-cost public access refuelling stations; and
 - Appropriate infrastructure is not financially viable without the vehicle uptake.
- 6.18 A number of respondents identified barriers in relation to vehicles:
- Eleven respondents noted increased vehicle, maintenance and conversion costs;
 - Four fossil fuel suppliers identified vehicle compatibility;
 - Five respondents stated vehicle availability;
 - Five fossil fuel sector respondents suggested a cross-border standard was needed;
 - Vehicle warranties are restricted to standard grade fuels; and
 - Negative perception of first generation dual fuel vehicles.
- 6.19 Nine respondents expressed concerns regarding fuel availability (e.g. of cellulosic hydrocarbon diesel), access to sustainable fuel and uncertainty on market size. Concern was also raised that biofuels have lower embodied energy, so are less efficient than conventional fuels.
- 6.20 Seven respondents suggested that the Renewable Heat Incentive provides higher biomethane support than the RTFO but that support for grid injection would help redress the balance.
- 6.21 Fossil fuel sector respondents suggested that Government should support operators and suppliers and focus on delivering benefits to end users via GHG reporting opportunities, and reported that measures to make HGVs more fuel efficient are commercially attractive.
- 6.22 Twelve respondents stated that RED targets do not require blending above B7 so there is no incentive for suppliers to incur the additional costs of delivering high biodiesel blends - nor for operators/retailers/consumers to pay them.

Addressing barriers in the HGV sector

Consultation proposal

- 6.23 The consultation asked a range of questions on decarbonising transport beyond the measures outlined in this consultation to amend the RTFO. Further context is provided above at question 39.

Question 41 – What should be the role of Government / Industry in addressing these barriers?

Summary of responses

Total	Comments
63	63

- 6.24 Respondents largely identified legislative and funding roles for Government, with some suggestions for industry-led and collaborative efforts.
- 6.25 Seven respondents suggested that there should be Government investment in strategic research for: vehicle compatibility and trials, fuel mixing, engine efficiency, higher blend fuels, gas fuel systems, food waste in anaerobic digestion, creation of a UK research hub, piloting measures and instruments to drive investment, recognition of the benefits and use of digestate and low carbon fertilisers, and mandating data-sharing, to collectively inform an implementation plan.
- 6.26 Twelve respondents suggested an RTFO target above 9.75% beyond 2020 would incentivise the delivery of higher blends and that other incentives should only be used if it is not possible to deliver Government targets with standard blends.
- 6.27 Eight respondents called for fiscal measures including: extending the fuel duty differential, setting fuel duty levels to reflect emissions, a fuel duty rebate for 100% bio and drop-in diesel, reducing excise duty on gas and extending capital allowances on gas infrastructure.
- 6.28 Other suggestions for Government included:
 - A technology neutral approach to legislation and engagement with EU standards;
 - RTFCs trading with a stable price, higher obligation level and a good buyout price;
 - Managing fuel scarcity to drive pricing;
 - Incentives for vehicle purchases and conversions;
 - Licensing changes such as operator exemptions for alternatively-fuelled category B vehicles;
 - Include high blend biofuels, biopropane and biomethane as development fuels;
 - Infrastructure loans and grants to reach 2030 targets;
 - Recognising emissions reductions from low carbon fertilisers;
 - Banning organic wastes to landfill;
 - Allowing gas trucks to run in low emission zones for 10 years, and the introduction of more low emission zones;
 - A HGV operators grant, like the bus service operators grant; and
 - Improving the image of biofuels and promoting the value of decarbonisation.
- 6.29 It was suggested that Government and industry focus on fossil fuel efficiency, reduce food miles by incentivising local supply, and support infrastructure for passing traffic.
- 6.30 It was suggested that industry develops business models, funds the cost of gas infrastructure for back-to-base fleets and leads in developing high blend fuels.

Initiatives to promote the use of biofuels into freight

Consultation proposal

6.31 The Department is looking at cost effective abatement measures for emissions reductions in the HGV sector and is keen to understand how these are perceived

Question 42 – Do road freight operators and freight fuel suppliers welcome initiatives to promote the use of biofuels into freight?

Summary of responses

Total	Yes	No	Other
35	14	14	7

6.32 Fourteen respondents suggested operators and fuel suppliers welcome initiatives to promote the use of biofuels and fourteen that they do not, the split reflecting sectoral differences. Those against cited issues around blending barriers, with higher blends requiring additional engine maintenance, infrastructure costs and logistical constraints. They suggested alternative incentives and stated a preference to deliver carbon savings in the most cost effective way; using current standard biofuel blends.

6.33 Five fossil fuel sector respondents sought to understand which initiatives are being considered, suggesting that blending standard grades should be favoured as long as sustainable feedstocks are the limiting factor.

6.34 Eight respondents highlighted a shift in welcoming carbon reduction initiatives, noting that:

- Consumers are becoming more aware of the carbon footprint of freight;
- Operator demand for a 100% renewable fuel;
- Operators are keen to demonstrate their sustainability credentials;
- Interest in 100% biomethane is strong due to low noise and local air pollutant levels, low emission zones and changes to green gas certificates;

But added that:

- It must be commercially viable as there is not a willingness to incur costs to 'go green' due to low profit margins within the freight and logistics sector; and
- Financial incentives are required, along with clear long-term Government support. Traditional fuel suppliers are less prepared to change, and regard gaseous fuels as a threat, though some suppliers are looking to facilitate change. A clear Government plan and a course of action for industry is needed.

6.35 Two renewable fuel suppliers and a road freight sector respondent reported that operators are interested in high bio-blends and that the majority of operators of existing gas-powered HGVs would use biomethane if it were priced comparatively to fossil fuels.

6.36 Five respondents suggested there is high engagement with opportunities to trial and experience biofuels as long as: these fuels perform consistently without compromising hardware, development costs are limited, there is a level playing field, and RTFO support is available.

Biofuel deployment into freight to 2020

Consultation proposal

6.37 The consultation proposed to raise the RTFO to 9.75% by 2020 to achieve 5-6% renewable energy in transport. Fuel suppliers currently determine where to deploy the RTFO-supported fuel most cost effectively. This question sought views on whether the level proposed would result in deploying renewable fuels directly into the freight sector.

Question 43 – Will the fuel industry deploy biofuels directly into road freight in the period to 2020 at the obligation level set out in this consultation (9.75% in 2020)?

Summary of responses

Total	Yes	No	Other
34	5	19	10

6.38 Responses were split between fossil and renewable sectors as to whether obligations would be met with standard or higher bio-blends, with both sectors identifying risks and barriers.

6.39 Of the nineteen respondents who said no:

- Eleven cited technical and commercial barriers (RED targets do not require blending of waste biodiesel above B7 so there is no incentive for suppliers to incur additional costs such as segregated supply and maintenance associated with delivering high blends, or for customers to pay them) stating that the obligation will be met through standard blends (EN590 and EN228);
- A fossil fuel supplier said it is unable to supply varying levels of fatty-acid-methyl-esters in road diesel and that all diesel will need to meet the most stringent requirements;
- A renewable supplier said niche suppliers will supply higher blends than those allowed at pumps because of constraints on flexibility with blending operations and that if up to 10% fatty-acid-methyl-esters were accepted, suppliers would deploy up to B10;
- Others stated the use of waste derived biodiesel and the fossil fuel sector double-counting to 'adjust' how it meets obligation, that haulage companies do not have the resources to support deployment without incentives, a lack of an RTFC price floor and volatile trade price and insufficient support for biomethane at volume; and

- Suggested solutions included stabilising RTFC prices and including liquefied natural gas terminals within mass balance rules.
- 6.40 Five respondents said the fuel industry would deploy biofuels directly into road freight in the period to 2020 at the obligation level set out in this consultation.
- 6.41 Other respondents suggested that the blending obligation would be met whilst respecting OEM recommendations, with existing B7 and E10 standards, and in the most cost-effective manner, respecting vehicle limitations such as blend walls. Three fossil fuel suppliers and one fossil fuel industry representative said they expect biofuels to be blended into diesel in line with obligations but that the logistics of the sector may not support multiple grades of diesel.
- 6.42 Those uncertain if blending limit levels will be reached stated that moving to higher blends would require regulation, financial support for infrastructure, and uptake amongst retailers and operators to ensure market demand. Respondents also noted that fuel must be financially viable and deliver consistent results. Risks identified were that it could be costly, undermine the security of supply and that emergency stocks of novel fuels would be needed in addition to commercial stocks.

Cost-effective promotion of biofuels in the freight sector

Consultation proposal

- 6.43 The Department is currently reviewing emission reduction opportunities in the HGV sector for cost effectiveness to inform policy decisions on how Government can promote biofuels in freight.

Question 44 – How can the Government cost effectively promote biofuels in the road freight sector?

Summary of responses

Total	Comments
29	29

- 6.44 Responses were varied but broadly focussed on using the existing RTFO, changes to fuel duty, funding for research, and support for biomethane.
- 6.45 Twenty respondents supported utilising the RTFO suggesting: introducing values to compete with supply of biofuels for heat, creating policy certainty in future RTFC rates, additional RTFCs for high blend use of biofuels in freight, a higher obligation, a sufficient buyout price and being technology neutral.
- 6.46 Ten respondents called for changes to fuel duty, with suggestions including: fuel duty based on energy content of fuel rather than volume, long-term incentives, a rebate for use of 100% bio and drop-in diesel, a duty reduction or incentive like the bus service operators grant, extending the differential between fuels and a 10p/litre duty rebate. A renewable supplier suggested extending first year capital allowances on gas refuelling infrastructure beyond 2018.

- 6.47 Eight respondents suggested increased funding for demonstration phases or competitions to support more projects and technologies, testing and evaluation of low carbon fuels, data-sharing, independent vehicle testing, ensuring vehicle compatibility and ensuring that biofuels deliver the same consistency as fossil fuels.
- 6.48 Seven respondents suggested that biomethane support should be provided under the development fuel sub-target. However, a consultancy suggested that waste derived biomethane should not be supported directly in HGVs. A fossil fuel supplier suggested there should be limits for a percentage of fleets to fuel their vehicles with biomethane and a renewable supplier suggested including high blend used cooking oil esters or tallow methyl esters in the development fuel sub-target.
- 6.49 Other suggestions were that:
- Freight companies need to actively seek to use such fuels to create market demand;
 - Public procurement programs should specify use of alternative fuels;
 - Greater use of waste feedstocks (a road haulage circular economy using return journeys for waste recycling);
 - RTFCs for mixed waste to fuel;
 - Action to bring more food waste to anaerobic digestion and to recognise the benefits and use of digestate;
 - Support with the cost of vehicles;
 - Conversions and infrastructure; and
 - Allowing mass balancing through the gas grid and GHG reporting with rewards reflecting the actual benefit of biofuel and promoting the benefits to public and industry.
- 6.50 Two fossil fuel suppliers suggested use of biofuels could be promoted by supporting processes for converting biomass to drop-in diesel fuels, giving gas trucks rights to access low emission zones in future, allowing quieter alternatively fuelled commercial vehicles to make night time deliveries, weight compensation and driver licence dispensation for heavier fuel tanks and rewarding operators who actively reduce emissions.
- 6.51 A fossil fuel supplier said that the UK's standard diesel fuel supply provides the best opportunity to blend biofuels within current fuel specifications (i.e. B7 diesel to the EN 590 standard) and an incentive is not needed to increase blending in the road or freight sector.

Government response

- 6.52 The Government welcomes the supportive and helpful suggestions and comments that stakeholders provided in response to questions 39-44 concerning how best to decarbonise the road freight sector given that it is a challenging area to electrify.
- 6.53 The response was largely positive recognising strong potential in market ready fuel blends and biomethane and in identifying potential in emerging technologies. Respondents were also positive in acknowledging a shift in attitudes towards carbon reduction and in welcoming initiatives to promote the use of biofuels in freight.

- 6.54 The RTFO was widely recognised as a cost effective mechanism to support biofuels into freight (and other diesel vehicles) through the UK's supply of standard diesel fuel. The Government notes that as lighter vehicles move increasingly to electric and other zero emission options, biofuel is expected to increasingly concentrate in the freight sector under the RTFO as suppliers meet their obligations.
- 6.55 Views provided as part of this consultation will be incorporated with the freight review appraisal and used to help inform future policy decisions on the RTFO and related measures. The department remains committed to decarbonising the HGV sector and is currently providing support through the RTFO, most recently in awarding certificates to biomethane injected to the grid. Support is also provided through the Advanced Biofuels Demonstration Competition and the Future Fuels for Flight and Freight Competition (F4C) with a continued focus on wastes.
- 6.56 In addition to these measures, the Government is supporting the use of biofuels in the road freight sector through the £20m Low Emission Freight and Logistics Trial. This will enable industry led trials of innovative vehicles or vehicle systems that can deliver real world emissions savings for the freight industry. The funding will support a range of alternative fuels and technologies, including trials of biomethane.
- 6.57 The Government will continue to monitor the evidence on the GHG performance of dedicated gas and dual fuel (diesel/gas) HGVs as new (Euro VI and beyond) products are developed so that we have more comprehensive data and are better able to compare emissions with conventional diesel trucks.
- 6.58 We are working to transpose amendments to the General Circulation Directive (Directive 96/53/EC) on vehicle weights and dimensions. This includes a requirement to give extra weight allowances of up to 1 tonne for certain HGV categories, to encourage the uptake of certain alternative fuel technologies (including biomethane).
- 6.59 The Government is currently developing proposals to seek an EU derogation that would allow Category B driving licence holders to operate slightly heavier commercial vehicles that are powered by alternative fuels. This would help achieve payload parity with conventional diesel vehicles and should therefore address a key barrier to the adoption of alternative fuels, which require heavier drivetrains.

7. Next steps

- 7.1 The Government thanks stakeholders for their responses to this consultation, as well as for their engagement during the development of it. The evidence provided during this consultation has been beneficial in helping us to finalise our policy proposals across the areas consulted on for this legislation.
- 7.2 We will introduce legislation to amend the Renewable Transport Fuels Obligations Order 2007 at the earliest opportunity.
- 7.3 We will continue to engage with stakeholders as we take the legislation through Parliament and finalise guidance on its operation to support its implementation and their preparation for it.

Annex A: Cost benefit analysis

See attached document.

Annex B: Consultation principles

The consultation has been conducted in line with the Government's key consultation principles which are listed at the link below.

<https://www.gov.uk/government/publications/consultation-principles-guidance>

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Department
for Transport

Annex A

Cost Benefit Analysis

Amendments to the Renewable Transport Fuel Obligations Order

Moving Britain Ahead

September 17

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1. Executive summary

- 1.1 Following the recent consultation on the future of the Renewable Transport Fuel Obligation, the resulting policy is illustrated in detail in the Government Response. For the purposes of this Cost Benefit Analysis, we focus on the policy changes with the highest expected impacts, namely the increase in the RTFO obligation, the level of the crop cap and the level of the development fuel sub-target. To illustrate the expected impacts of these, we compare the central policy scenario to a do-nothing baseline.
- 1.2 To ensure long-term carbon savings, investor certainty and a link to carbon budgets, new RTFO obligation levels will be set from 2018 to 2032 and the costs and benefits are estimated for this time period. Increasing the RTFO obligation for this period contributes the UK's Carbon Budgets 3 to 5 (2018-2032) and ensures compliance with the EU Renewable Energy Directive and makes significant contributions to Fuel Quality Directive compliance.

Table 1: summary of options consulted on

	sub-target	Approach to crop-based renewable fuels (% total fuel volume)
Option 1	Broad definition	Increase use of crops (up to 7%)
Option 2 (preferred)	Fuel-specific	Maintain current crop use (up to 2%)
Option 3	Fuel-specific	Phase out crop use (0%)

- 1.3 The final policy is an amended version of Option 2 with a fuel specific development sub-target and a revised limit to crop-derived fuels. To estimate the impacts of the policy for this CBA, we have developed a central scenario of the fuels we consider most likely to be delivered under the new policy. Later in the CBA, we show sensitivity analysis of how these impacts may vary. The proposed measures are expected to add slightly to fuel pump prices, though any increase is more than offset by improvements in vehicle efficiency in recent years, which has been supported by government regulations.¹ The total cost in 2020 is estimated to be £351m (0.9ppl). This cost estimate is driven by the expected price spreads between fossil fuels and renewable fuels in global markets. However, as these cost projections are inherently uncertain, alternative market price scenarios have been modelled which provide a wider range of cost estimates (0.3 to 1.9 pence per litre (ppl) or £127m to £725m in total, in 2020).

¹ We estimate that the average petrol car on the road is around 8% more fuel efficient in 2016 than the average in 2009. Given petrol prices around 110ppl at the pump this fuel saving reduces driving costs by the equivalent of 9ppl.

- 1.4 We expect that the development sub-target will support the development of a new industry supplying advanced transport fuels and playing an important role in decarbonising road transport in the longer term. The overall obligation also maintains a market for current suppliers of the most sustainable fuels, the waste biodiesel industry, and existing UK ethanol producers.
- 1.5 There is an absolute increase in the demand for biofuels, which will contribute to meeting ambitious carbon budgets and will also ensure stable demand for renewable suppliers while the demand for fossil fuels is expected to decline. Currently, the majority of biofuels used in the UK are also processed in the UK and we estimate that this adds at least £60 million per year to the UK economy (net value added). We would expect the proposed policy to increase this contribution and estimates are included in table 3 below under "Present value benefits".

Table 2: 2020 pump price impact, carbon abatement cost, renewable energy

Costs are additional to baseline in 2020, 2015 prices	2020 Cost impact, £m (range)	2020 Pump price impact minus VAT, ppl (range)	Additional VAT revenues, ppl (range)	Total pump price impact, ppl (range)	2020 Crop share (% by volume)	GHG savings ¹ (MTCO ₂ e)	Abatement cost ¹ (£/TCO ₂ e) in 2020	TWh renewable Energy (incl. baseline)
Central	351 (127-725)	0.72 (0.24-1.52)	0.18 (0.06 – 0.38)	0.9 (0.3 – 1.9)	1.7% (0-4%)	2.8	123 (44-256)	23.1
Option 2 for comparison	366 (143-729)	0.72 (0.24-1.52)	0.18 (0.06 – 0.38)	0.9 (0.3 – 1.9)	2% (0-2%)	2.7	137 (53-273)	22.5

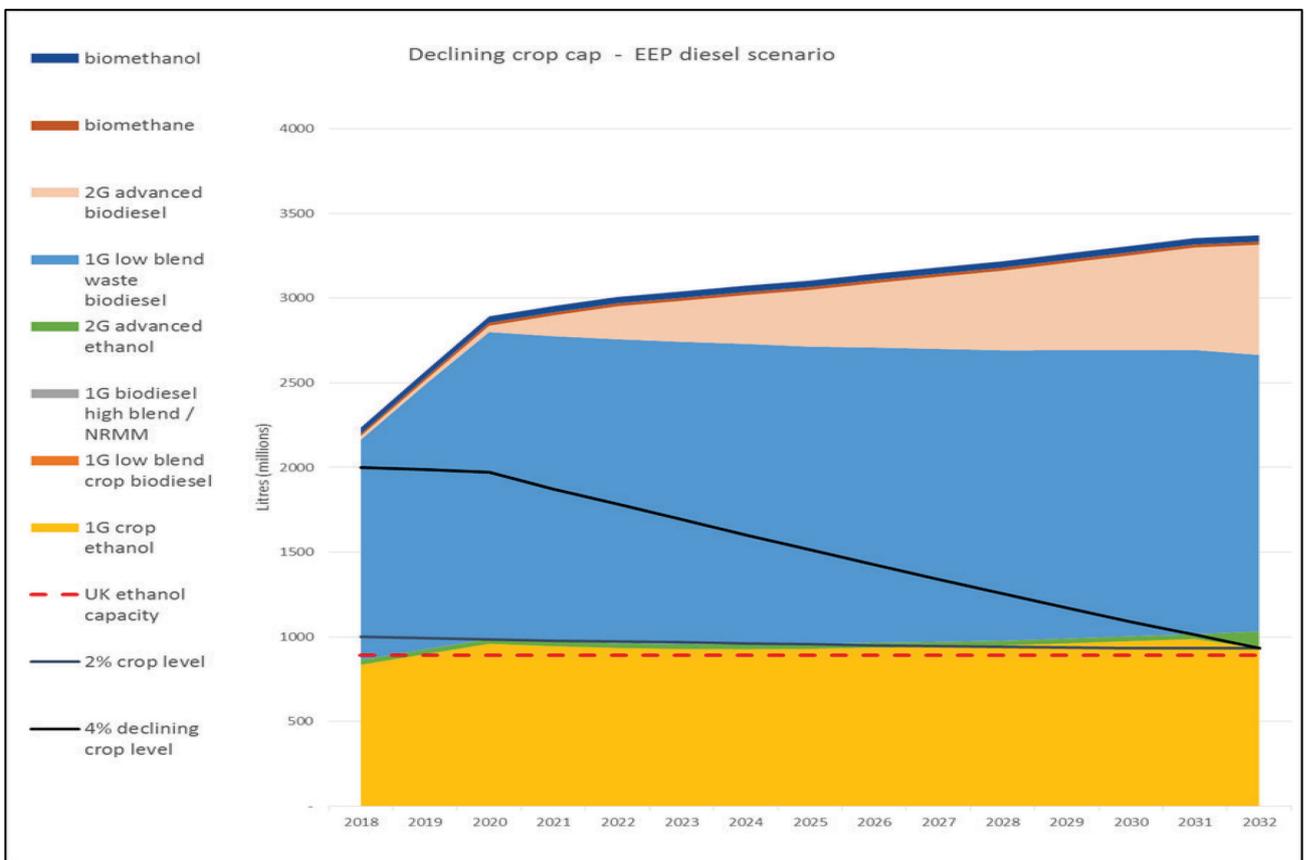
Table 3: summary of present value estimates (2018-2032):

Additional to baseline, 2015 prices	Total additional carbon savings ¹ (MTCO ₂ e)	Present value benefits (£m)	Present value costs estimate (£m)	Average abatement cost present value ¹ (£/TCO ₂ e) 2018-32	Present value costs (£m) range	Net present value (£m) range	Net present value (£m) central estimate
Central	52	3567	4276	119	1534 to 9313	2033 to -5746	-709
Option 2	33.6	2303	3107	95	1213 to 6313	1090 to -4011	-804

- 1.6 The central net present value estimates are negative, since we expect the cost of renewable fuels to exceed the value of the carbon saved plus the net value added to the UK economy. This holds true under BEIS's central and low non-traded carbon value projections. When we use BEIS's high carbon value projections for sensitivity analysis, the NPVs are positive. NPVs are also positive if we apply carbon budget methodology instead of lifecycle carbon accounting.

- 1.7 The central scenario assumes high levels of waste availability. It also assumes that E10² will be introduced and will make up 40% of retailed petrol with 60% remaining E5. Sensitivity analysis was carried out to show impacts for "noE10" and "HighE10". It is important to note that the high crop cap in the early years allows a much higher uptake of crop derived fuels than we have in the central scenario, and especially crop biodiesel. We have also undertaken a sensitivity to show impacts for high crop biodiesel uptake.
- 1.8 Table 3 above shows the expected impacts over the duration of the policy. The range of net present value estimates is based on three different long-term price scenarios (driven by global markets).

Chart 1: summary of renewable fuels supplied over the duration of the policy, central scenario



² A blend of petrol and ethanol with up to 10% ethanol.

2. Problem under consideration and rationale for intervention

- 2.1 The Climate Change Act set a target of an 80% reduction in greenhouse gas emissions by 2050 compared to 1990 levels. As around one quarter of UK carbon emissions are from transport, decarbonisation of the transport sector is vital to achieving this long term goal. Renewable fuels are expected to have an important role to play in delivering this long-term decarbonisation. Despite increased uptake of electric vehicles, a significant share of road vehicles and virtually all planes and ships are expected to still use liquid or gaseous fuels well into the 2030s, showing the need for further low-carbon options and for a strategy beyond meeting the 2020 targets. Advanced renewable fuels could be key to this long-term decarbonisation, as they may provide a means to decarbonise heavy goods vehicles (HGVs), ships and aircraft, where electrification is difficult or impractical, few alternatives to liquid or gaseous fuels are available and increased supply of first generation biofuels is either unavailable or unsustainable.
- 2.2 Currently, UK fuel suppliers are obligated to provide 4.75% (by volume) of road transport fuel from renewable sources, under the Renewable Transport Fuel Obligation (RTFO). However, this falls short of what is required to meet carbon budgets and also falls short of the Renewable Energy Directive's transport sub-target, which requires 10% of road transport fuel by energy to be from renewable sources in 2020.
- 2.3 Current supply of renewable fuels under the RTFO is 3.3% by volume (4.75% if you include double reward of waste derived fuels) and 2.6% by energy (4% with double rewarding).

3. Policy

3.1 The consultation put forward three policy options and we still refer to those options for comparison in this CBA. To quantify the impacts of the final policy, we compare estimated impacts against a '*Do-nothing*' baseline, which assumes the RTFO remains as it is with an obligation level of 4.75% by volume, with double rewarding of waste-derived fuels, no sub-target for development fuels and no crop cap. The policy options were partly informed by the requirements of meeting the Renewable Energy Directive in 2020 as well as the requirements of carbon budgets. The baseline is not considered as a viable policy option because it does not ensure compliance with carbon budgets or with the minimum requirements of the RED.

Policy options considered for consultation

3.2 The three policy options all required an increased uptake of biofuels, however they put a different emphasis on the source and the sustainability of those biofuels. A brief summary of what differed between policy options is in Table 4 below.

Table 4: summary of differences between options

	sub-target	Approach to crop-based renewable fuels (% total fuel volume)
Option 1	Broad definition	Increase use of crops (up to 7%)
Option 2 (preferred)	Fuel-specific	Maintain current crop use (up to 2%)
Option 3	Fuel-specific	Phase out crop use (0%)

3.3 All policy options incorporated the following aspects:

- a. Increase obligation to 2020
- b. Continue obligation to 2030
- c. Introduce development fuel sub-target
- d. Set a cap on crop-derived renewable fuels
- e. Introduce a number of operational amendments

Policy changes which are reflected in this cost benefit analysis

1) Increase the obligation level and continue obligation to 2032

3.4 Currently the RTFO requires obligated suppliers to blend 4.75% of renewable fuels by volume into fossil petrol and diesel. Waste-derived fuels count twice towards this obligation. The proposed obligation level for 2020 is 9.75% by volume, which will contribute to meeting the third Carbon Budget (2018-2022). It also complies with the Renewable Energy Directive when combined with the 1.1% of renewable electricity used in electric vehicles and trains.³ Post-consultation, we have decided to increase the obligation level further post-2020 as below, while still awarding double certificates to waste-derived fuels.

Table 5: Proposed obligation levels to 2032

Obligation period	PRE CONSULTATION Target (obligation) level, as share of total liquid fuel by volume, may include double rewarding	POST CONSULTATION Target (obligation) level, as share of total liquid fuel by volume, may include double rewarding
15.4.2017-14.4.2018	6.00%	4.75%
15.4.2018-31.12.2018*	7.25%	7.25%
2019	8.50%	8.50%
2020	9.75%	9.75%
2021	9.75%	10.1%
2022	9.75%	10.4%
2023	9.75%	10.6%
2024	9.75%	10.8%
2025	9.75%	11.0%
2026	9.75%	11.2%
2027	9.75%	11.4%
2028	9.75%	11.6%
2029	9.75%	11.8%
2030	9.75%	12.0%
2031	9.75%	12.2%
2032	9.75%	12.4%

*note 2018 is a short obligation period so that we can switch to a calendar year from 2019.

³ The renewable portion of electricity used in rail and road transport can be counted towards the RED transport sub-target, with multipliers of 2.5x and 5x respectively. The proportion of electricity that is renewable has been assumed at the RED accounting default of 30%. The net result is that 1.1% of the 10% transport sub-target is met through renewable electricity in transport.

2) Introduce a sub-target for particular 'development' fuels

3.5 To take advantage of the commercial opportunities and environmental benefits of advanced renewable fuels we propose the introduction of a 'development fuels sub-target' to incentivise the production of new, more sustainable advanced fuels from waste feedstocks. We have decided to focus this sub-target on specific fuels that are most consistent with the UK's long term strategic needs, namely those suited for aviation and road freight where electrification options are most limited. In addition we seek to incentivise fuels that broaden the base of waste feedstocks beyond those currently processed. To give industry time to ramp up supply, the proposal is to require 0.05% of fuels (by volume) to come from 'development' fuels in 2019, increasing gradually to 1.4% in 2032. There will be separate certificates awarded for development fuels under the RTFO, dRTFCs. These will be used to meet the development fuels sub-target, or alternatively can be used to meet the main obligation. The development sub-target will have its own buy-out price, which will be set at 80 pence per certificate (up to £1.60 per litre of fuel).

Table 6: the volume requirements of the development fuels sub-target are:

Obligation period	PRE CONSULTATION Sub target (obligation) level, includes double rewarding	POST CONSULTATION Sub target (obligation) level, includes double rewarding	Resultant "development" renewable fuel supply as proportion of total fuel supply (by volume)*
15.4.2017-14.4.2018	0.1%		
15.4.2018-31.12.2018*	0.2%		
2019	0.3%	0.1%	0.05%
2020	0.4%	0.15%	0.075%
2021	0.6%	0.5%	0.25%
2022	0.8%	0.8%	0.4%
2023	1%	1%	0.5%
2024	1.2%	1.2%	0.6%
2025	1.4%	1.4%	0.7%
2026	1.6%	1.6%	0.8%
2027	1.8%	1.8%	0.9%
2028	2%	2%	1%
2029	2.2%	2.2%	1.1%
2030	2.4%	2.4%	1.2%
2031	2.4%	2.6%	1.3%
2032	2.4%	2.8%	1.4%
Post-2032	2.4%	Review obligation in line with Carbon Budget 6	

* As development fuels will be eligible for double reward, the resultant development fuel supply is calculated as half of the sub-target. However, the actual development

fuel supply may be lower where gaseous fuels are supplied under the sub-target (as these will attract more than two RTFCs per kg).

3) Limit crop-derived renewable fuels

3.6 To ensure that an increase in the RTFO obligation leads to the use of sustainable fuels, we are capping the amount of crop-derived fuels that can be awarded RTFCs. The cap is intended to reduce the risk of additional carbon emissions from Indirect Land Use Change (ILUC), which can occur in the production of crop-based biofuels. We are putting in place a declining crop cap:

Table 7: maximum share of crop derived fuels (by volume)

	Maximum share of crop derived fuels rewarded RTFCs (volume)
2018	4.00%
2019	4.00%
2020	4.00%
2021	3.83%
2022	3.67%
2023	3.50%
2024	3.33%
2025	3.17%
2026	3.00%
2027	2.83%
2028	2.67%
2029	2.50%
2030	2.33%
2031	2.17%
2032	2.00%

3.7 The CBA does not estimate the costs or benefits associated with operational changes to the RTFO, beyond the impacts of the development sub-target, the increased obligation and the limit to crop-derived fuels.

4. Analytical approach, evidence, uncertainties and sensitivities

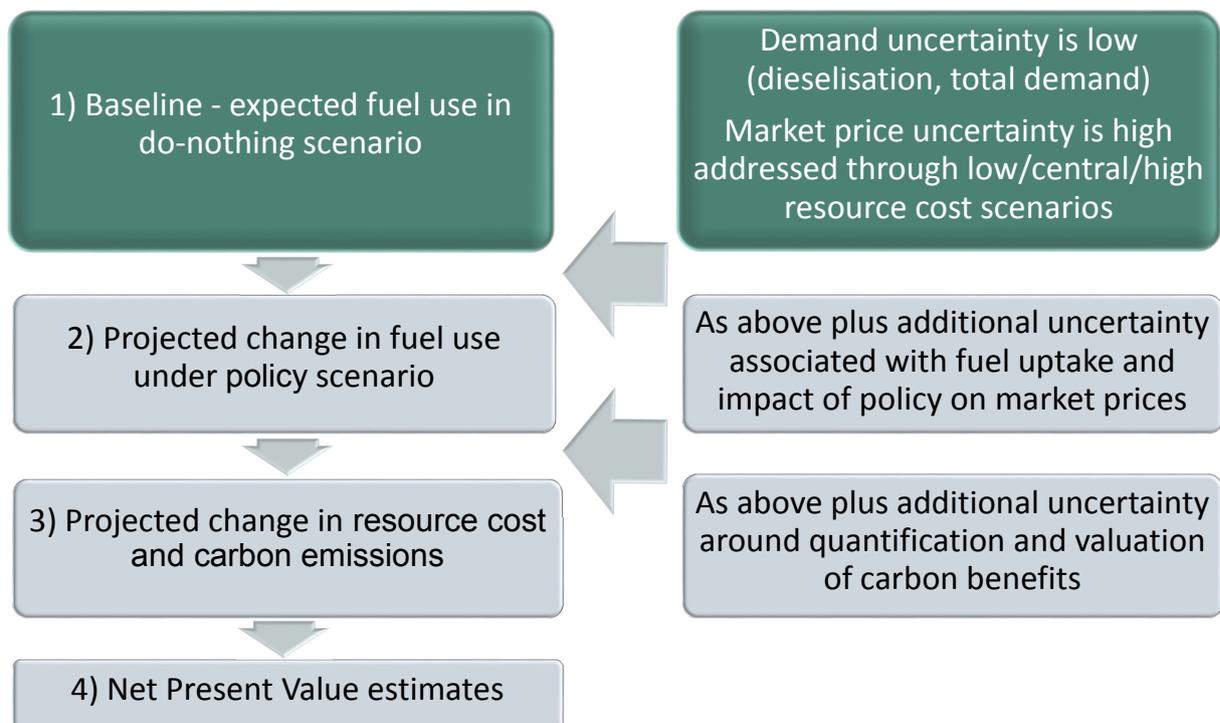
Analytical approach

Estimating changes in fuel use, resource cost and carbon savings

4.1 The impacts of policy amendments are estimated in four steps:

- 1 Determine the volume of different fuels supplied under the baseline
- 2 Quantify the expected change in fuels used relative to the baseline once the new policy has been implemented (i.e. less fossil, more renewable, and a changing share of feedstocks)
- 3 Based on this change, estimate carbon saved/emitted through the increased use of renewable fuels (benefit estimate) and change in resource cost (cost estimate). In addition, we have estimated net value added to the UK economy as a benefit
- 4 Use cost and benefit estimates to generate a range of net present value estimates

4.2 The flow chart below shows the four steps and highlights where there is considerable uncertainty around key inputs:



- 4.3 To estimate the quantity of different renewable fuels supplied under the baseline and new policy (steps 1 and 2), we assume that fuel suppliers meet the obligation at least cost subject to certain constraints. The estimated supply of fuels under the baseline and new policy is based on assumptions about overall demand for road transport fuel, the petrol/diesel split, blending limits and projections of the relative costs of supplying different types of fuel.
- 4.4 The calculation of fuel costs and carbon benefits for the central scenario (step 3) draws on the estimated fuels supplied, estimated in steps 1 and 2. To estimate the costs we combine the estimated fuels supplied under the baseline and new policy with estimates of the resource cost differential between renewable fuels and fossil fuels.⁴ (This uses resource cost estimates in £/MWh, to account for the different energy density of different fuels.)
- 4.5 To estimate the benefits of each option, we combine the estimated fuels supplied under the baseline and new policy with estimates of the greenhouse gas intensity of renewable and fossil fuels. This allows us to calculate the change in carbon emissions relative to the baseline. We then value the changes in emissions in each year following guidance published by BEIS.

Estimating Net Value Added to the UK economy

Estimating economic value added per litre:

- 4.6 We calculate an average cost of the inputs to each fuel (UCO for biodiesel, wheat for ethanol). We then look at the corresponding price data for the outputs (biodiesel, ethanol and the by-product "distillers grains" (DDGS), which is used as animal feed), to calculate gross value added per litre of biofuel.

Estimating share of RTFO supply coming from UK sources:

- 4.7 We then estimate what share of additional biofuel feedstocks come from UK sources. Combined with our processing assumptions, this gives us the total additional biofuels supply processed in the UK. To calculate this, we looked at the total of each biofuel supplied in year 7 of the RTFO, calculated the share that came from UK sources, and developed three scenarios for sources of additional future supply:
 - Optimistic: Same proportions UK/abroad as present
 - Pessimistic: All additional biofuel comes from abroad
 - Central: Halfway between optimistic and pessimistic

Estimating share of biofuels processed in UK:

- 4.8 For this, we assume that all biofuels that come from UK feedstocks and that are supplied into the UK are also processed here. For biofuels that are sourced from abroad, we first calculate the current share of UK-processed biofuels that come from non-UK feedstocks, by taking total production of that biofuel and the total quantity of that biofuel supplied into the UK that also uses a UK feedstock.

⁴ Please note that the cost of blending renewable fuels and generating RTFCs depends on the difference in market prices between fossil fuels and renewable fuels, which is why we use the terms "price projections" and "cost projections" interchangeably in this CBA.

Once this share is calculated, we again create three scenarios that match up with those above:

- Optimistic: 50% increase in current proportion of imported biofuel feedstocks processed in UK
- Pessimistic: 50% decrease in current proportion of imported biofuel feedstocks processed in UK
- Central: Processing - same proportion of imported biofuel feedstocks processed in UK as present

Estimating Gross Value Added

4.9 To calculate the gross value added to the UK economy by the biofuels industry, we use the figures outlined above to calculate what proportion of the additional biofuels supplied under the RTFO CBA scenarios are produced in the UK in each year, and then multiply this by our economic value added per litre estimates.

Factoring in additionality

4.10 Gross value added, however, does not provide a full picture of the economic impacts. It is very likely that at least some of the capital investment and jobs created in this industry will simply be diverted from other uses and are therefore not really additional. We must therefore estimate how much of this impact is additional to a 'do-nothing' baseline.

4.11 To do so, we have calculated three 'additionality' percentages, which estimate what proportion of the gross impacts are additional to the baseline and therefore a benefit attributable to the policy. These are based on information given to us by the biofuels industry, and match up to the three scenarios outlined above. These are then multiplied by their respective gross value-added estimates to give us a range of net value-added estimates.

4.12 We consider that some of the value which is not additional and which would have been generated in the UK economy in the absence of this policy would have come from the fossil fuel industry. Hence some of the value lost to the fossil fuel industry is indirectly taken into account here. However, we appreciate that this may not fully reflect the impact of the policy on the fossil fuel industry.

Converting to Net Present Values (NPVs)

4.13 Once we have net value-added figures for each year, we time-discount these according to the standard Green Book guidance, using an annual discount rate of 3.5% and taking 2015 as the base year. This gives us the final monetised impacts that can be compared and combined with the rest of the RTFO CBA analysis.

Assumptions

4.14 Profit and spending on capital and labour are considered additional to the baseline; feedstock and operating costs are not. All biofuels supplied under the RTFO and with feedstocks sourced from the UK are assumed to have been

processed/produced in the UK. The value-added per litre of biofuel remains constant in real terms until 2030.

- 4.15 Due to limited information, at present we assume that the share of advanced biofuels processed in the UK is equivalent to that of waste biodiesel. This assumption may be revised if further information comes to light.
- 4.16 There are a range of other economic benefits that are extremely difficult to quantify. These include the potential benefits for energy security from associated UK production and reduced reliance on imported animal feed. We have not attempted to quantify these.
- 4.17 The final step in the analysis is to combine all the estimated costs and benefits of each option, and discount them to produce net present value estimates.

Evidence and assumptions

- 4.18 The evidence and assumptions we use to model impacts build on the evidence agreed by Working Group 1 of the Transport Energy Taskforce in early 2015⁵ and have more recently been shared and tested with stakeholders, at a workshop in December 2015. Some aspects of these have been updated post-consultation. They are explained in detail in Appendix 1 and include:
 - Projections for road transport energy demand from BEIS's Energy Projections
 - Projections for petrol/diesel split from DfT scenarios and BEIS's Energy Projections
 - Price projections for the different types of renewable fuels supplied under the RTFO
 - Different scenarios for E10 uptake: No E10, High E10 and central E10
 - Contribution of electricity to meeting the RED sub-target
 - Availability of waste-derived fuels
 - Assumed carbon intensity of different fuels
 - Value of carbon savings

Key uncertainties and sensitivity analysis

- 4.19 Below, we explain what we consider to be the main uncertainties in the modelling, by order of impact/importance, and how we have addressed the uncertainty:
 - Difference in costs of supplying renewable fuels and fossil fuels
 - Uptake of E10 fuel
 - Use of crop biodiesel
 - Dieselisation of the vehicle fleet
 - Waste biodiesel price/availability
 - Valuing carbon savings

⁵ <http://www.lowcvp.org.uk/projects/transport-energy-task-force.htm>

- ILUC factors
- 'Development' renewable fuels availability
- Biomethane uptake
- The uncertainties around blending of biofuels into NRMM (fuels used for non-road mobile machinery)

Difference in costs of supplying renewable fuels and fossil fuels

- 4.20 The uncertainty around the policy costs is driven by a range of factors. The key single factor we have identified is uncertainty around market price developments, i.e. how renewable fuel prices change in relation to fossil fuel prices. Global energy and commodity markets are inherently volatile and future market developments are notoriously difficult to predict, but the price spread between fossil fuels and renewable fuels determines the cost impact of the policy. To capture this uncertainty, we have developed low/central/high projections of the price spreads between renewable fuels and fossil fuels. (See Appendix 1 for details)⁶ These are based on historical spreads and are projected independently of the underlying fossil fuel prices and commodity prices. In the analysis, they are used to generate ranges of cost estimates and net present values.
- 4.21 In our central price scenarios, the spreads between fossil fuels and renewable fuels fall steadily, since historically the cost of renewable feedstocks has fallen faster than the cost of fossil fuels. We also consider the possibility of spreads either rising (high price scenario) or falling faster (low price scenario).

Uptake of E10 fuel

- 4.22 There is also high uncertainty around the future uptake of E10 due to a range of factors including consumer acceptance. The future uptake of E10 has a significant impact on which mix of renewable fuels is likely to be supplied but it has a less significant impact on costs and benefits.
- 4.23 Since ethanol has significantly lower energy density than petrol, fossil diesel or renewable diesel, whether E10 is introduced and the extent of uptake affects how much total renewable energy is supplied. We have developed three different uptake scenarios for E10 to estimate the impact on total renewable energy being supplied. The different E10 uptake scenarios are:
- i) no uptake (the UK continues to use E5)
 - ii) medium uptake (a mid point between E5 and high uptake)
= central scenario
 - iii) high uptake (85% E10 and 15% E5)
- 4.24 For quantifying costs and benefits in this CBA, we use the central scenario 'moderate E10 uptake'. In section 5, we show as a sensitivity analysis what

⁶ Please note that the cost of blending renewable fuels and generating RTFCs depends on the difference in market prices between fossil fuels and renewable fuels, which is why we use the terms "price projections" and "cost projections" interchangeably in this CBA.

different levels of E10 uptake would mean for renewable energy being delivered as well as costs and benefits.

- 4.25 Sections of industry have commented that they consider a 'moderate' E10 uptake highly unlikely, because there are limitations to the refining and refuelling infrastructure that make it challenging to supply a wider variety of fuel grades than currently available. As such, the view of some stakeholders in the industry is that the 'no E10 uptake' and 'high E10 uptake' are more likely than our central scenario. However, the experience in other countries which have deployed E10 has generally not been a wholesale switch of the standard grade of petrol from E5 to E10. In Germany, France and the Netherlands there has been a moderate uptake of E10, with some refuelling stations offering E5 whilst others offer E10. As in the UK, there are few forecourts in these countries that offer more than two grades of petrol (typically 'super' and standard grade), so typically individual fuel stations either have E5 or E10 as the standard grade.

Use of crop biodiesel

- 4.26 The higher crop cap in the early years of the policy allows potentially for the use of some crop biodiesel. It is uncertain under which circumstances the market would supply this, as it is currently nearly absent from the UK fuel supply. If the crop cap allows crop biodiesel, its use may still be limited by the B7 blendwall of biodiesel. For the purpose of a sensitivity analysis, we have included some crop biodiesel up to the B7 blendwall in the early years of the policy.

Waste biodiesel availability/price

- 4.27 The market for waste biodiesel has a slightly different dynamic from the other renewable fuels, since it has fewer uses and would not be traded globally if it was not for European demand for it as a transport fuel. The demand for waste biodiesel is driven by EU renewables policy and is set to increase between now and 2020. In addition to the uncertainty of global commodity markets, which indirectly affect waste biodiesel prices, there is also significant uncertainty around the availability of waste feedstocks and how the prices of waste derived fuels will respond to a significant increase in European (and UK) demand in the run-up to 2020.
- 4.28 For the pre-consultation CBA we looked at different cost projections just for waste biodiesel. Consultation responses assured us that in principle enough waste biodiesel can be supplied. And given that the policy now includes a crop cap, which is unlikely to be filled with crop ethanol in the early 2020s, there will be less upward market pressure on waste biodiesel prices than we considered for policy options 2 and 3 and for the sensitivity analyses of the pre-consultation CBA. The central scenario in this CBA uses the same waste biodiesel cost projections that were previously used for policy option 1 with no crop cap. We still include a sensitivity analysis for a scenario where waste biodiesel becomes scarce and market prices increase significantly.

Dieselisation of the vehicle fleet

- 4.29 The dieselisation of the fleet is relevant, since it determines how much ethanol can be blended, and blending ethanol is expected to remain the most cost-

effective option for generating RTFCs. We use BEIS' EEP projections for our central diesel/petrol split and also perform a sensitivity analysis using a declining diesel share. (See appendices for details)

Valuing carbon savings

4.30 We use BEIS carbon values for carbon savings in the non-traded sector to estimate carbon saving benefits. Alongside their central values, BEIS also provide high and low carbon values, which we have used for a sensitivity analysis.

ILUC factors, and GLOBIOM as sensitivity test

4.31 There is some uncertainty around the amount of carbon saved by the policy, and specifically around the importance of indirect land use change for different renewable fuels.

4.32 The greenhouse gas intensities we use reflect lifecycle emissions and take account of ILUC emissions factors published in the revised Renewable Energy Directive, which provide current best evidence on the net greenhouse gas benefits of using biofuels. (See appendix for values.)

4.33 As a sensitivity, we also repeat the analysis with ILUC factors from the recently published GLOBIOM study. Recent research published by the GLOBIOM consortium, commissioned by the European Commission, has suggested that ILUC emissions from crop-based biofuels may be significantly higher than previous estimates.⁷ This is especially so for crop-based biodiesels.

4.34 We have therefore examined the effects of a 'GLOBIOM' scenario on our central scenario. ILUC values from the directive and from the GLOBIOM study are shown in Appendix 1. Using GLOBIOM values reduces carbon savings NPVs are shown in Annex 4.

'Development' renewable fuels availability

4.35 The fuels required by the development fuel sub-target may not be available in 2019 when the development sub-target is introduced. We have included a high cost estimate across all scenarios for these fuels for 2019 and 2020 to account for the possibility of buy out.

Non-Road Mobile Machinery (NRMM)

4.36 There is also uncertainty regarding the future share of renewable fuels that is used in non-road mobile machinery. This fuel counts towards the RTFO but not towards the RED. If there was a significant increase in renewable fuels being used in NRMM, this would increase the risk of the RED target not being met, however this seems unlikely. In the analysis, we assume that biodiesel is only blended in road diesel. As the biodiesel blend in road diesel approaches the blendwall, we may see some biodiesel blended into NRMM fuels or used in HGVs and busses as high blends. However, we would not expect this to

⁷ https://ec.europa.eu/energy/sites/ener/files/documents/Final%20Report_GLOBIOM_publication.pdf

happen, unless there is a significant shift to petrol and away from diesel, which would reduce the maximum capacity for biodiesel blending in road fuel.

Biomethane

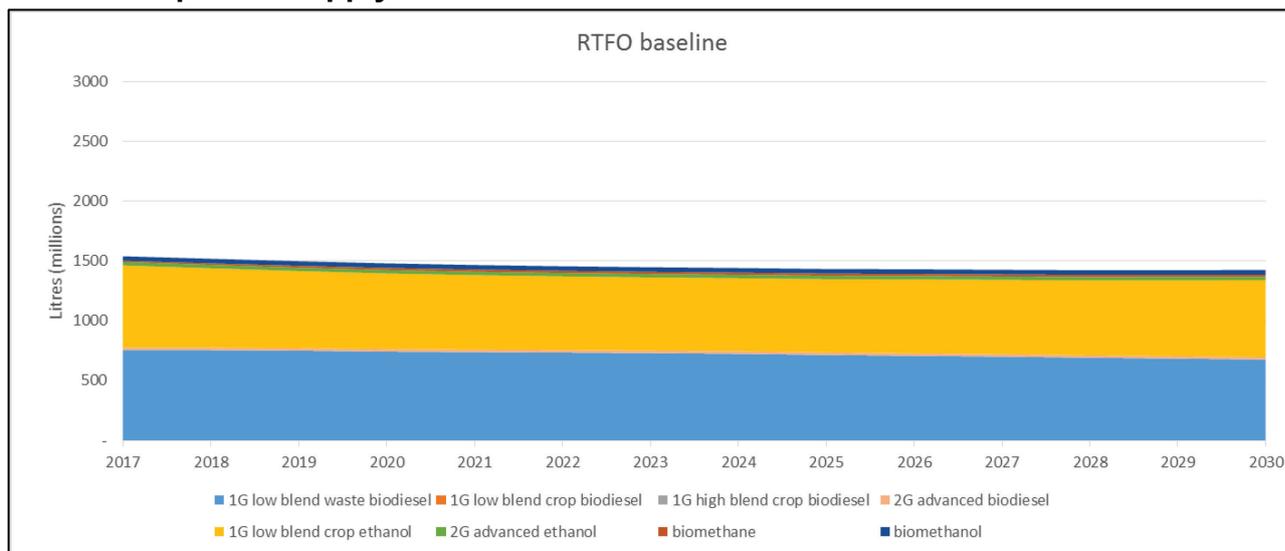
4.37 Biomethane uptake scenarios were developed for the 2015 amendments to the RTFO and are also included in the baseline of this analysis. (Details are in Appendix 1.)

5. Impacts of the policy on fuels supplied and GHG emissions

Baseline fuel supply

5.1 In the absence of any amendments, we would expect the proportion of renewable fuels to continue at similar levels to those seen in recent years. Our projections for total demand and for the petrol/diesel split are based on BEIS's Energy and Emissions Projections 2016 (EEP)⁸. (Details are shown in Appendix 1). Projected baseline volumes are shown in chart 2.

Chart 2: expected supply of biofuels under the RTFO baseline



5.2 We do not expect the fuels supplied to vary between low/central/high price scenarios. This is because the relative cost effectiveness of generating RTFCs from different fuels is not expected to change between different price scenarios (e.g. ethanol is always expected to be the cheapest per litre, and the price of waste biodiesel is always higher than the price of crop biodiesel per litre).

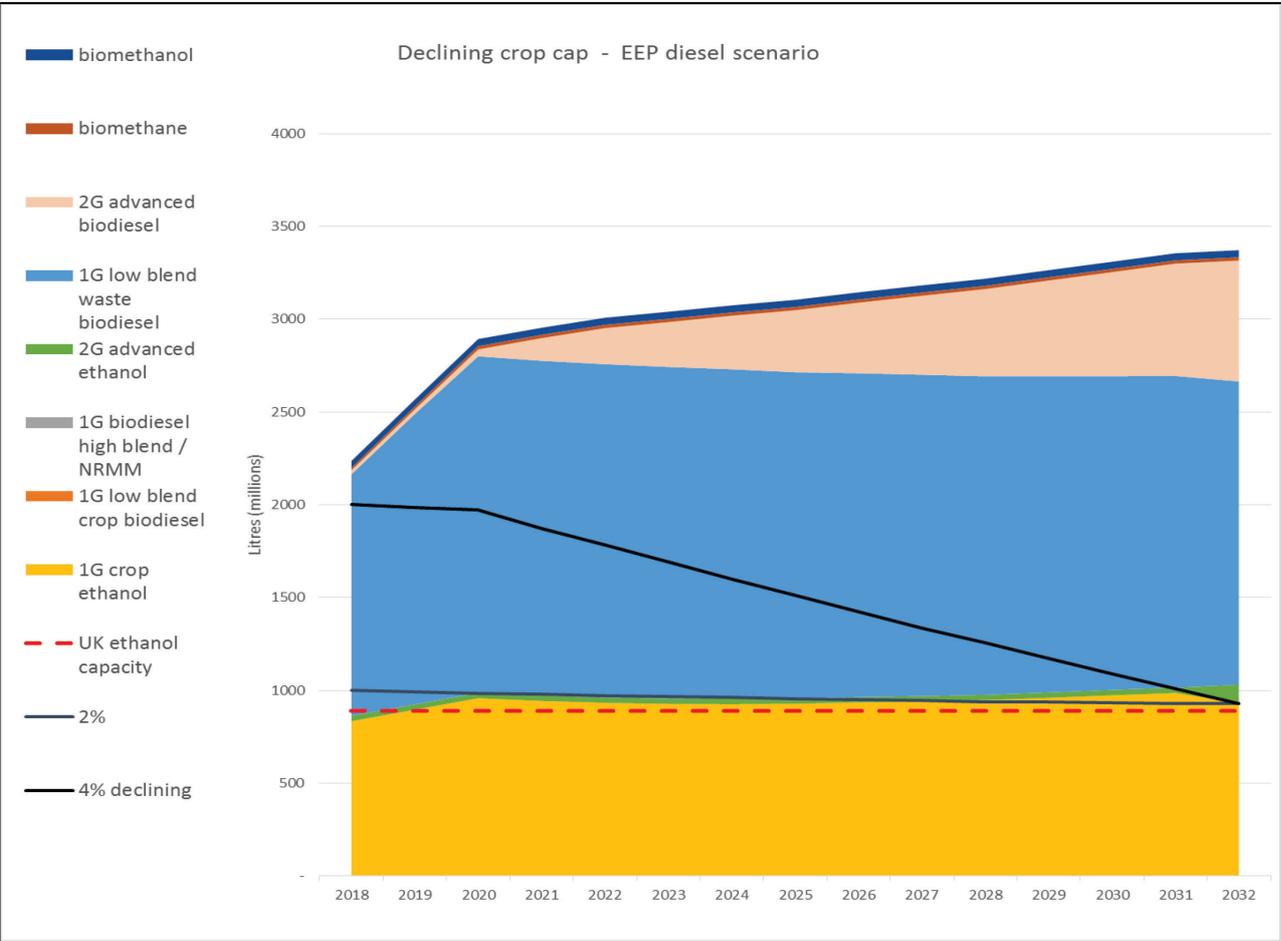
⁸ <https://www.gov.uk/government/collections/energy-and-emissions-projections>

Fuel supply under the policy

Impacts of the increased obligation and development fuels sub-target

5.3 Increasing the RTFO obligation and introducing a development fuel sub-target requires larger volumes of renewable fuels to be used than under the baseline. For our central scenario we assume moderate uptake of E10, which drives the amount of ethanol that can be supplied. We look at high E10 and No E10 as a sensitivity. We do not expect significant volumes of crop biodiesel to be supplied but we look at potential supply of crop biodiesel as a sensitivity.

Chart 3: overview of renewable fuels supplied 2018-2032 by volume - central scenario



5.4 This fuel supply would meet the transport sub-target of the RED in 2020 and would also contribute to meeting the 2020 FQD target.

Table 8: contribution to the 2020 Fuel Quality Directive target

% contribution to 6% FQD target	2019	2020
With policy	3.81%	4.45%

Table 9: renewable fuels as proportion of total liquid road fuels, with development fuel sub-target in place

Obligation period	Target (obligation) level, as share of total fuel by volume	"Development" sub-target (counted twice towards RED)	Remaining obligation to be met with other renewable fuels
2018	7.25%		7.25%
2019	8.50%	0.05%(0.1%)	8.4%
2020	9.75%	0.075%(0.15%)	9.6%
2021	10.1%	0.25%(0.5%)	9.6%
2022	10.4%	0.4%(0.8%)	9.6%
2023	10.6%	0.5%(1%)	9.6%
2024	10.8%	0.6%(1.2%)	9.6%
2025	11.0%	0.7%(1.4%)	9.6%
2026	11.2%	0.8%(1.6%)	9.6%
2027	11.4%	0.9%(1.8%)	9.6%
2028	11.6%	1%(2%)	9.6%
2029	11.8%	1.1%(2.2%)	9.6%
2030	12.0%	1.2%(2.4%)	9.6%
2031	12.2%	1.3%(2.6%)	9.6%
2032	12.4%	1.4%(2.8%)	9.6%

5.5 The obligation % listed above may include significant amounts of double counted materials. For compliance with the Renewable Energy Directive's overall target, it is also important what the fuel supply translates into in terms of TWh of renewable energy.

Table 10: TWh of liquid and gaseous renewable fuels used in road transport

	Baseline (TWh)	With policy (TWh)
2018	11.5	17.5
2019	11.4	20.3
2020	11.3	23.1
2021	11.2	23.7
2022	11.1	24.2
2023	11.0	24.5
2024	11.0	24.9
2025	10.9	25.1
2026	10.9	25.5
2027	10.8	25.8
2028	10.8	26.1
2029	10.7	26.5
2030	10.7	26.9
2031	10.7	27.2
2032	10.7	27.3

Table 11: progress towards meeting the RED transport sub-target

Some tables are by volume

Some are by energy

Obligation period	Target (obligation) level, as share of total liquid fuel by volume	% of transport sub-target met through renewable fuels with E5 (estimate, includes double rewarding and development fuel sub-target, by energy)	% of transport sub-target met through renewable fuels with moderate E10*** (estimate, includes double rewarding and development fuel sub-target) by energy	% of transport sub-target met through renewable fuels with high E10** uptake (estimate, includes double rewarding and development fuel sub-target) by energy
1/1/2019 – 31/12/2019	8.50%	8.1%	8.0%	7.9%
1/1/2020 – 31/12/2020	9.75%	9.4%	9.2%	9.0%
2020 contribution renewable electricity		1.1% (4.77 TWh)	1.1% (4.77 TWh)	1.1% (4.77 TWh)
Total		10.5%	10.3%	10.1%

* note 2018 is a short obligation period so that we can switch to a calendar basis.

** Assumes 15% of E5 and 85% of E10 on average across the entire petrol supply, i.e. an overall ethanol content of 9.05% by volume

*** Assumes 59.5% of E5 and 40.5% of E10 on average across the entire petrol supply, i.e. an overall ethanol content of 6.825% by volume. This is half way between no E10 and high E10 and is meant to reflect uncertainty around actual E10 uptake.

- 5.6 Under the Renewable Energy Directive, renewable electricity used in electric road vehicles and trains will also count towards meeting the requirements of the Directive. We expect this to account for 4.77 TWh or 1.1% of the transport sub-target in 2020, based on methodology provided by the RED.⁹
- 5.7 In addition to the contribution from E5, E10 and development fuels, we would expect the majority of renewable fuel to come from biodiesel, either waste-derived or crop-derived. This is because there is significant room to deploy biodiesel within the 7% "blend wall" provided by the diesel standard EN590 (nationally, deployment is currently around 3%). We also expect small amounts of other renewable fuels, such as renewable methanol.
- 5.8 Appendices 2 and 3 show how we would expect supply to develop, both in volume and in energy terms. The chart below shows the overall trajectory.

⁹ Article 3, paragraph 4, point c, page 14 of the amendments document here: <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015L1513&rid=2>.

Renewable fuel supply above baseline - with policy

5.9 In summary, we expect the below volumes to be supplied under the policy, in addition to the baseline.

Table 12: renewable fuel additional to baseline

Fuel supplied additional to RTFO baseline	1G Ethanol (million litres)	Waste biodiesel (million litres)	Fuels supplied under the development fuel sub-target (million litres)	Total (million litres)
2018	172	547		361
2019	253	814	3	719
2020	327	1071	15	1071
2021	322	1066	101	1414
2022	319	1061	173	1489
2023	317	1057	220	1553
2024	317	1051	267	1594
2025	317	1043	313	1635
2026	320	1037	359	1673
2027	321	1032	404	1716
2028	324	1025	449	1757
2029	328	1020	494	1797
2030	332	1015	539	1842
2031	337	1011	584	1887
2032	270 ¹⁰	972	630	1931

Carbon savings with policy

5.10 The main benefits that we expect to see from the increased use of renewable fuels are savings in carbon emissions above the baseline of the existing RTFO obligation. The exact savings depend on which fuels are used to meet the increased RTFO obligation and also the development fuel sub-target.

5.11 From the volumes of renewable fuels that are supplied and the volumes of fossil fuel that they displace, we have modelled the savings for the fuel use projected under the central scenario.

¹⁰ Plus 72 million litres of advanced ethanol

Table 13: estimated total carbon savings additional to baseline with policy, including ILUC, mtCO₂

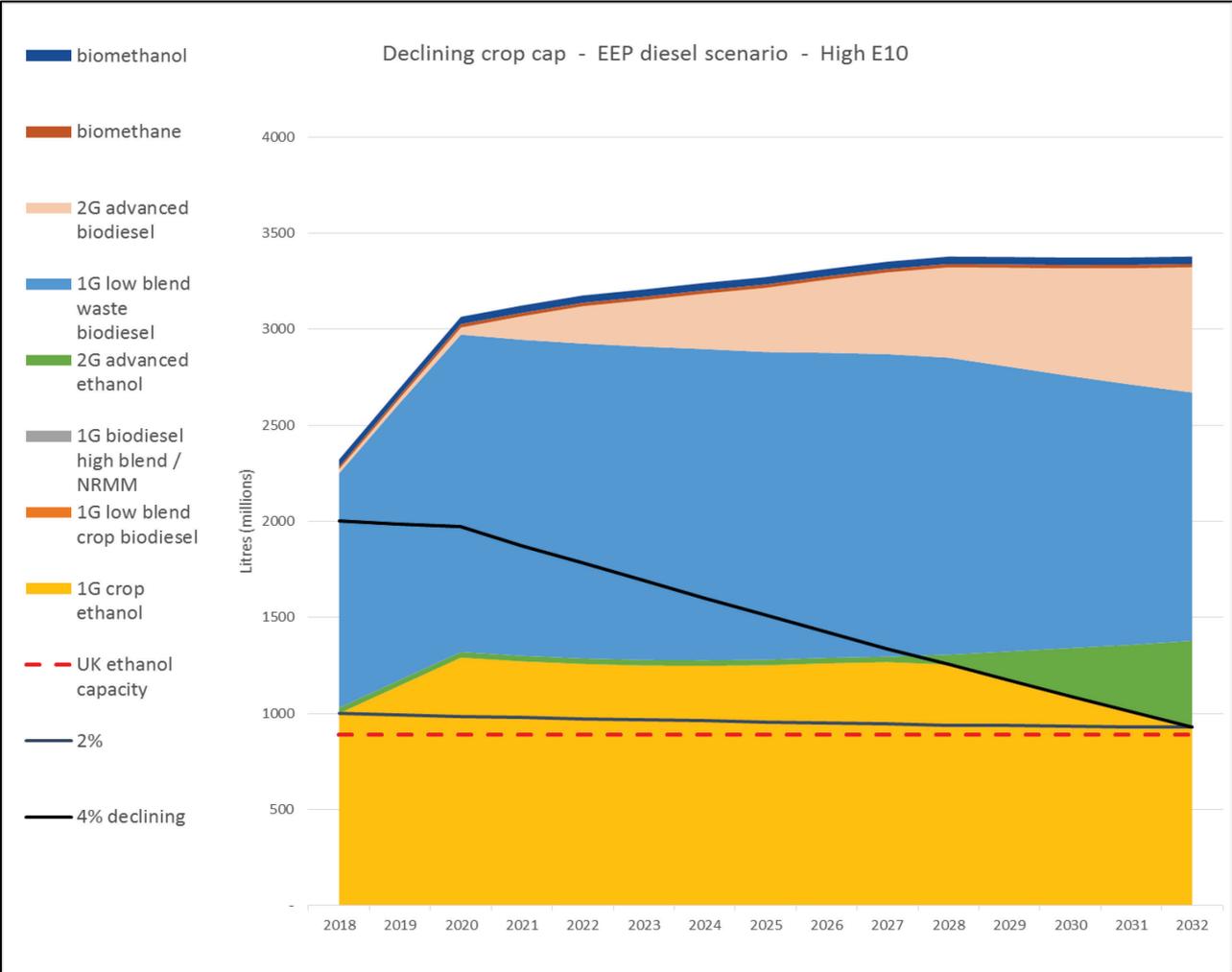
GHG savings additional to baseline, MTCO ₂ e	With Policy
2018	1.43
2019	2.14
2020	2.84
2021	3.07
2022	3.26
2023	3.39
2024	3.51
2025	3.62
2026	3.74
2027	3.86
2028	3.98
2029	4.10
2030	4.22
2031	4.35
2032	4.43
Total	52

Sensitivity analysis

High E10 Trajectory

5.12 Since there is considerable uncertainty around the future use of E10, we have considered alternative uptake scenarios. If there is a high E10 uptake, the demand for crop ethanol is likely to exceed the crop cap. At that point, we would expect to see an increased uptake of advanced, waste-derived ethanol post-2028. (Some waste-derived ethanol is already supplied under the current RTFO.)

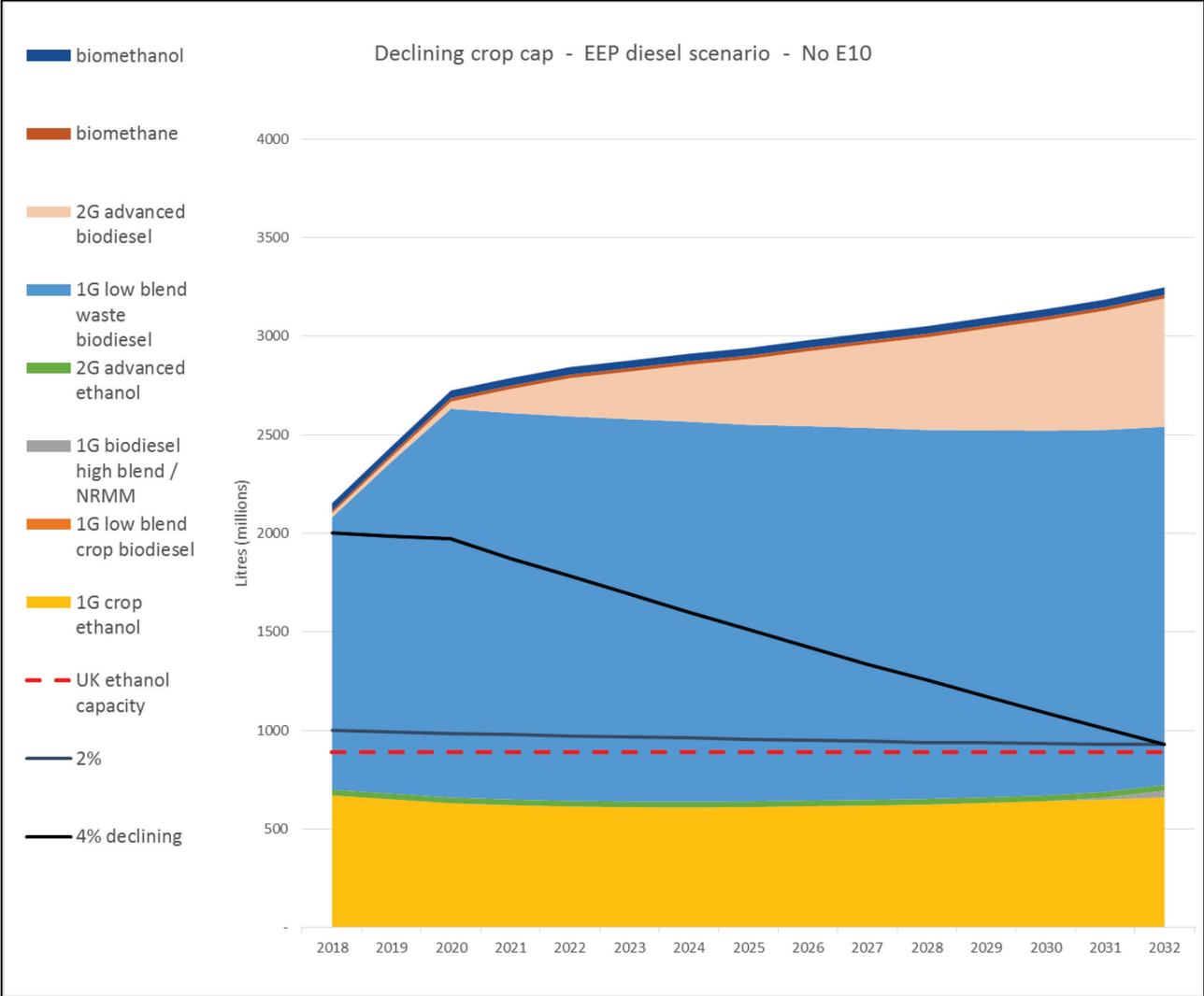
Chart 4: fuel projection with high E10



No E10 trajectory

5.13 Equally, it is possible that there will be no uptake of E10, and the obligation needs to be met with E5, biodiesel and advanced fuels. In this scenario, we would not see any demand for advanced ethanol. For our central diesel assumptions, it remains possible to meet the RTFO obligation without the need for high blend diesel or NRMM.

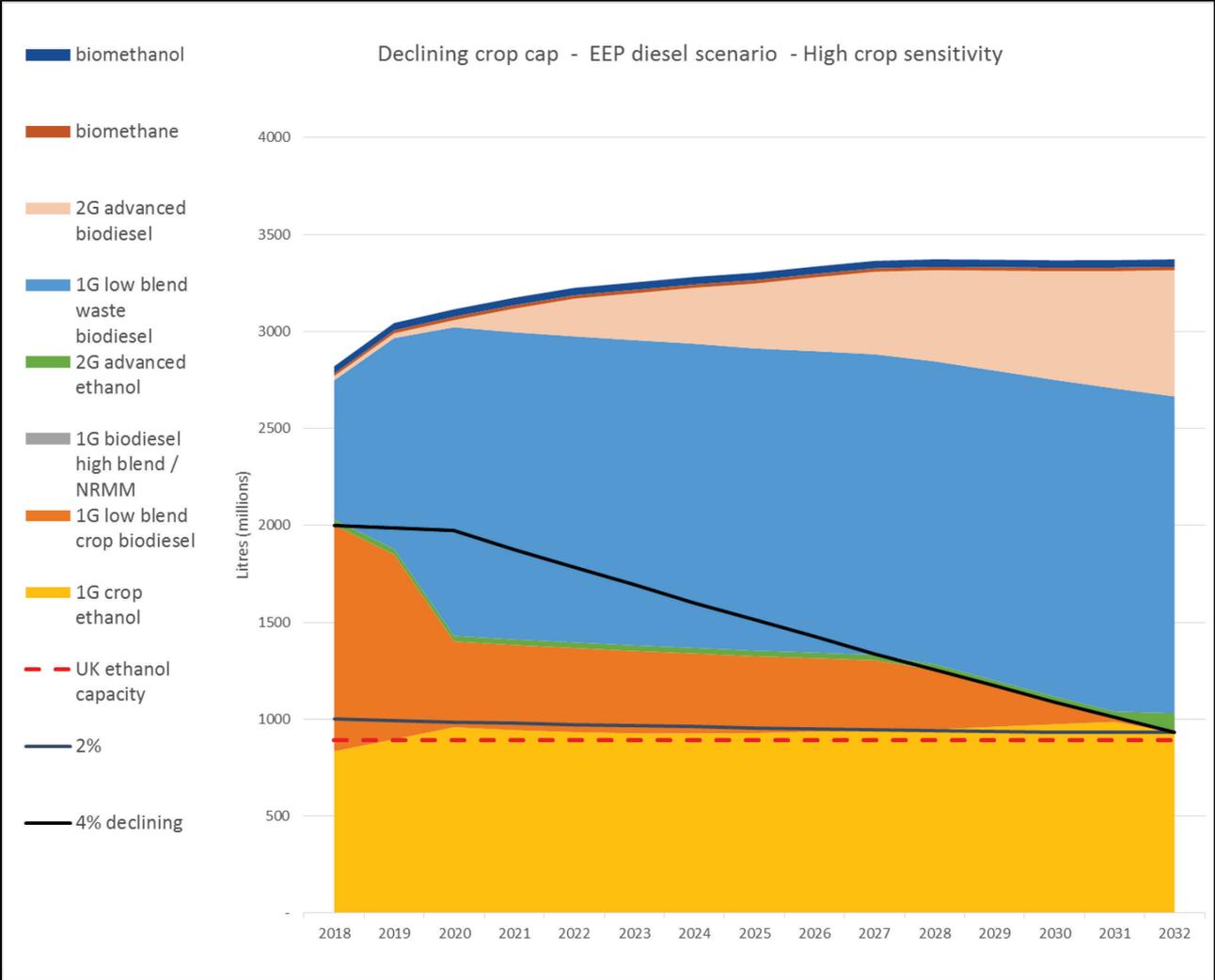
Chart 5: fuel projection without E10



High-crop biodiesel trajectory

5.14 Under the B7 blend wall and the declining crop cap, it would be possible to see significant amounts of crop biodiesel supplied, although we do not consider this likely and it is not part of our central scenario. For illustrative purposes, the chart below shows the maximum possible amount of crop biodiesel that could be supplied under the declining crop cap and the B7 blend wall. The strange shape of this supply profile is due to the blendwall limiting supply from 2020 onwards but not before.

Chart 6: possible high-crop biodiesel trajectory (million litres)



6. Costs and benefits of the policy

Summary of costs and benefits

6.1 The two tables below show a summary of impacts both for the duration of the policy and for 2020. The range presented in these tables does not cover the full range of values presented in the CBA as it does not include sensitivities.

Table 14: summary of net present value estimates (2018-2033)

Additional to baseline, 2015 prices	Total additional carbon savings (MTCO _{2e})	Present value benefits (£m)	Present value costs central estimate (£m)	Present value costs (£m) range	Net present value (£m) range, (benefits minus costs)	Net present value (£m) central estimate
With Policy	52	3567	4276	1534 to 9313	2033 to -5746	-709
Consultation Option 2	33.6	2303	3107	1213 to 6313	1090 to -4011	-804

Table 15: 2020 pump price impact, crop share, carbon abatement & RED compliance cost

Costs are additional to baseline in 2020, 2015 prices	2020 Resource cost impact, £m (range)	2020 Pump price impact, ppl (range)	2020 Crop share (% by volume)	RED compliance cost (£/MWh)	Abatement cost (£/TCO _{2e}) in 2020	Average Abatement cost present value (£/TCO _{2e}) 2017-30 or 2018-2032
With Policy	351 (127-725)	0.9 (0.3-1.9)	1.7% (0-4%)		123 (44-256)	119
Consultation Option 2	366 (143-729)	1.0 (0.4-2)	2% (0-2%)	31.2	137 (53-273)	95

6.2 The quantified benefits of the proposed changes are lower carbon emissions from transport as well as value added to the UK economy from domestic biofuel production. This includes the expected development of an industry that can deliver low carbon transport fuel in the long run. The main cost impacts are higher fuel costs, since renewable fuels are more expensive than fossil fuels per unit of energy.

- 6.3 These proposed carbon savings are already included in BEIS's latest emissions projections. If they were not realised, additional carbon savings would need to be generated elsewhere in order to meet carbon budgets.
- 6.4 There is considerable uncertainty around the cost estimates, since the cost impact is driven by two volatile variables, the market price of fossil fuels and the market price of renewable fuels. In spite of significant uncertainties, we have developed projections of the price differential between fossils and renewables. (See Appendix 1.) The price projections are first derived per MWh and not per litre, to account for the different energy content of different fuels. To make them accessible to the audience, we also present them in terms of pence per litre spreads.
- 6.5 Based on our central price projections, the methodology outlined in Section 4, and the evidence outlined in Appendix 1, the estimated cost impacts and carbon savings of the policy is shown below:

i - Quantified impacts

- 6.6 The tables below show central estimates of quantified costs and benefits over the duration of the policy

Table 16: cost impacts and carbon savings with policy and above baseline (2015 prices, undiscounted)

Additional to RTFO baseline	Energy used (TWh)	Price premium (£/MWh)	Cost impact (£m)	Pump price impact (ppl)	Carbon savings without ILUC (MTCO _{2e})	Carbon savings with ILUC (MTCO _{2e})	Abatement cost* (£/TCO _{2e})
2018	6.00	30	178	0.47	1.65	1.43	124
2019	8.95	29	263	0.70	2.46	2.14	123
2020	11.84	30	351	0.94	3.27	2.84	123
2021	12.54	31	391	1.06	3.50	3.07	127
2022	13.13	32	423	1.15	3.70	3.26	130
2023	13.51	32	433	1.19	3.83	3.39	128
2024	13.88	32	440	1.21	3.95	3.51	125
2025	14.22	31	444	1.23	4.06	3.62	122
2026	14.61	31	448	1.25	4.19	3.74	120
2027	14.98	30	450	1.26	4.31	3.86	116
2028	15.34	29	448	1.27	4.43	3.98	113
2029	15.73	28	445	1.26	4.56	4.10	109
2030	16.13	27	440	1.25	4.68	4.22	104
2031	16.52	28	463	1.32	4.81	4.35	106
2032	16.62	30	499	1.43	4.88	4.43	113

*includes ILUC factors

Net Present Values

6.7 The table below shows the central net present value estimates (NPV = discounted benefits minus discounted costs) for the policy under different cost projection scenarios.

Table 17: summary of NPVs

£m, 2015 prices	Discounted							
			Low Cost		Central Cost		High Cost	
	Total carbon benefits	Net value added	Resource cost	Net cost/ benefit	Resource cost	Net cost/ benefit	Resource cost	Net cost/ benefit
2018	85	16	65	36	160	-59	261	-160
2019	124	24	86	62	229	-81	426	-278
2020	162	31	106	88	295	-102	610	-417
2021	172	43	114	100	318	-104	664	-450
2022	179	51	119	111	332	-102	689	-459
2023	183	56	117	121	329	-91	691	-452
2024	186	60	121	125	323	-78	690	-445
2025	188	63	121	130	314	-63	686	-434
2026	191	67	117	140	307	-50	680	-423
2027	193	70	111	151	298	-35	672	-410
2028	195	72	103	164	287	-20	663	-395
2029	197	75	94	178	275	-3	653	-382
2030	199	77	84	192	263	13	643	-367
2031	216	79	85	210	267	28	643	-348
2032	231	84	89	226	278	37	643	-327
Total	2701	866	1534	2033	4276	-709	9313	-5746

NPVs under sensitivity analysis

6.8 Detailed NPV estimates for sensitivity analyses are shown in appendix 4.

ii - Non-quantified impacts

6.9 Beyond the impacts on resource costs and carbon savings that have been quantified for this cost benefit analysis, we would expect to see wider economic impacts which we have not attempted to quantify.

Impacts on motorists

6.10 Increasing the RTFO obligation level with a crop cap at or above current levels of crop-derived supply (options 1 or 2) will increase the likelihood of E10 being introduced to the market, and there are possible consequences and real consumer impacts associated with the introduction of E10 including:

- Limited access to E5 on forecourts, which would be problematic for drivers of older, incompatible cars. This only applies to older petrol cars and by current estimates this will affect around 5% of drivers of petrol cars by 2020.
 - The cost per mile driven increases marginally due to the lower energy content of ethanol.
- 6.11 We are aware of the potential impacts of E10 introduction on E10-unsuitable vehicles, and have examined them as part of the review of the E5 protection grade. We will consult on an extension to the protection grade.

Impacts on fuel suppliers

- 6.12 The policy represents an increase in demand for the renewable fuels industry as a whole. It also generates the opportunity for a new industry to emerge to supply fuels under the development sub-target. We attempt to reflect this in the CBA through "net value added" estimates for the increase in first generation fuels as well as the supply of development fuels. The value added methodology recognises that not all value generated by these suppliers is new or "additional".
- 6.13 An increase in the RTFO obligation and the introduction of the "development fuels" sub-target may increase the risk that fossil fuel suppliers will choose to buy out of the obligation.
- 6.14 The new requirement on the UK to report ILUC impacts of crop-derived fuels is not expected to generate an administrative burden on fuel suppliers but could affect the public image of some fuel suppliers.
- 6.15 The changes to the 'carry-over' of RTFCs will also have an impact on fuel suppliers, especially the suspension of the RTFC carryover from 2019 to 2020. However, we do not have enough evidence to quantify these impacts.

Impacts on the wider economy

- 6.16 Apart from contributing to UK carbon budgets, the policy contributes to meeting the requirements of the Fuel Quality Directive, the transport-specific RED sub-target, and the cross-sector 2020 RED target, the latter of which requires 15% of energy to come from renewable sources across heating, electricity generation and transport.
- 6.17 For the UK economy as a whole, fuel security is expected to increase as dependence on imported fossil fuels decreases.

7. Appendices

Appendix 1 - Details of analytical evidence and assumptions

Current share of biofuels and baseline renewable share

7.1 The current share of biofuels is used to estimate biofuel use under the baseline. The table below shows UK biofuels historically supplied under the RTFO, as recorded in RTFO statistics.¹¹

Table 18: renewable fuels supplied under the RTFO by volume

million litres	2012/13 (Year 5)	2013/14 (Year 6)	2014/15 (Year 7)	2015/16 (Year 8)
Total fuel use	44,706	50,417	50,882	51,666
Single rewarded renewable fuels	805	933	835	920
Double rewarded renewable, after double reward	1,058	1,621	1,662	1,840
Single + double rewarded renewable	1,863	2,554	2,496	2,485
as % of total (incl. double reward)	4.2%	5.1%	4.9%	4.96%

Table 19: fuels supplied historically under the RTFO as % of energy supplied and baseline projections

Fuel	2012/13 (Year 5)	2013/14 (Year 6)	2014/15 (Year 7)	Model Baseline
Biodiesel	1.05%	1.63%	1.57%	1.53%
Ethanol	1.09%	1.01%	0.98%	0.93%
Other fuels	0.07%	0.07%	0.02%	0.14%
Total	2.21%	2.71%	2.57%	2.6%
RED contribution (including fuels that are double rewarded)	3.24%	4.12%	4.01%	4.27%

¹¹ <https://www.gov.uk/government/collections/biofuels-statistics>

Demand projections

7.2 Projections for road transport energy demand from BEIS's EEP 2015:

This is taken from BEIS's Energy and Emissions Projections (EEP) 2015, Reference scenario. <https://www.gov.uk/government/collections/energy-and-emissions-projections>

All existing and planned UK government policies are taken into account. It projects that total energy demand will come to 421 TWh and 468 TWh in 2020 (for the purposes of the RED and FQD respectively). Given the relative stability of total energy demand, we have not modelled sensitivities around this.

Chart 7: transport energy demand projections, TWh

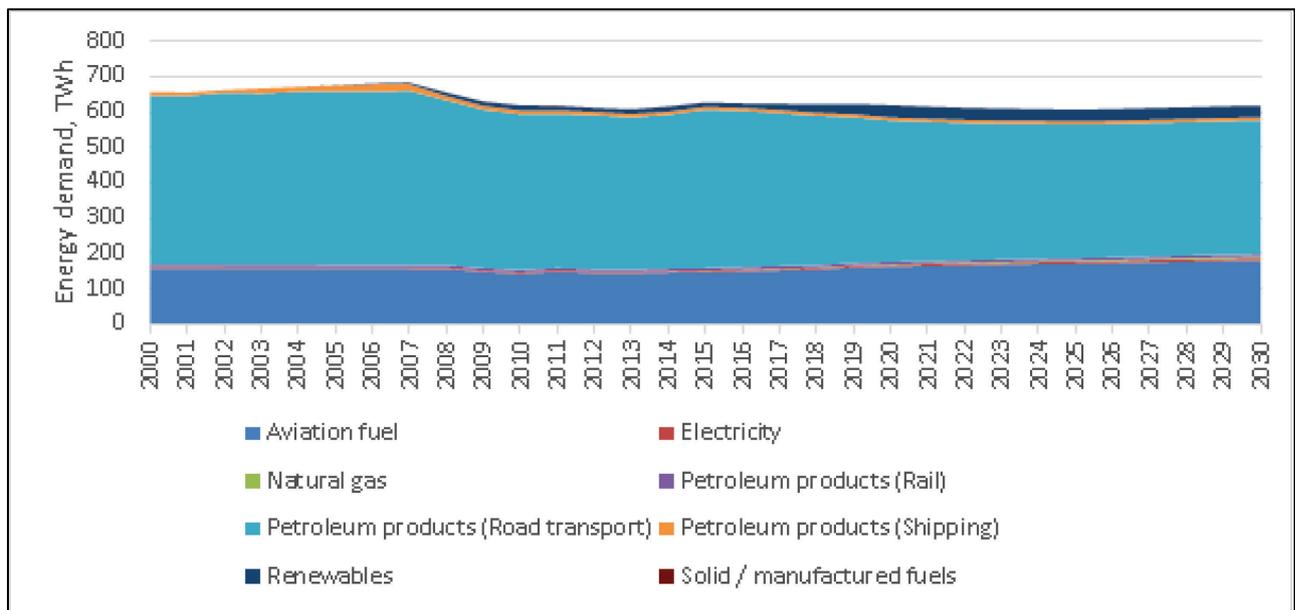
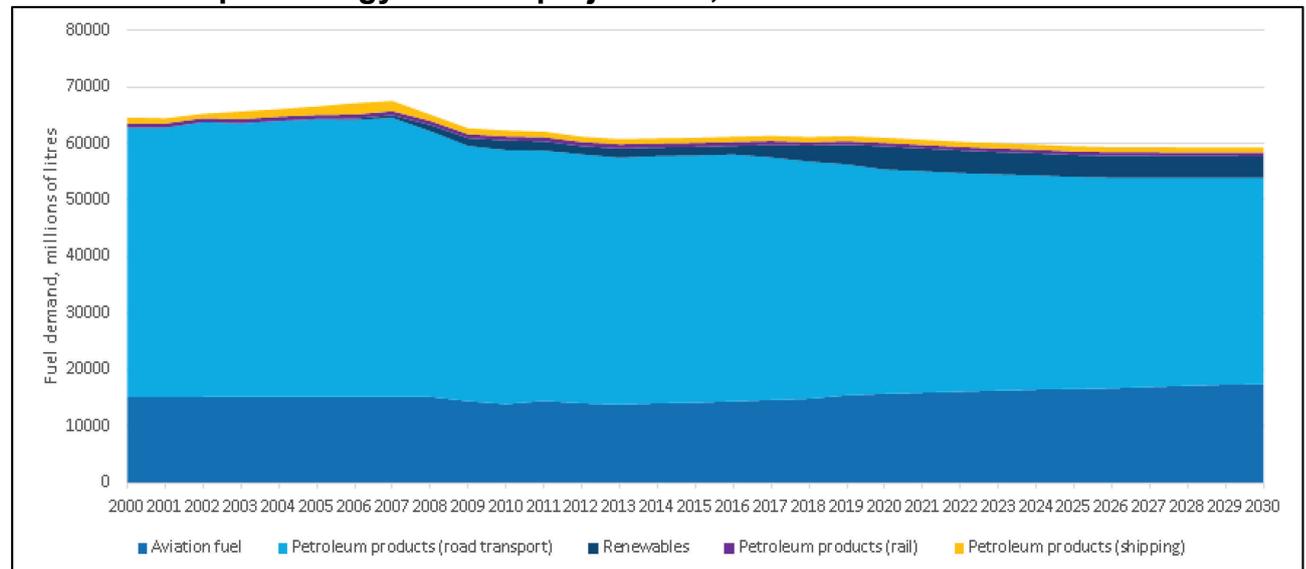


Chart 8: transport energy demand projections, million litres



7.3 Projections for petrol/diesel split from EEP 2015

This is also taken from BEIS's EEP 2015.
<https://www.gov.uk/government/collections/energy-and-emissions-projections>

It projects that the diesel share of road transport energy will rise from 65% in 2015 to 70% in 2020. Given potential uncertainty, we have also modelled a 'low dieselisation' scenario, where we examine the impact of a reversal in the dieselisation trend.

Chart 9: updated EEP demand projections

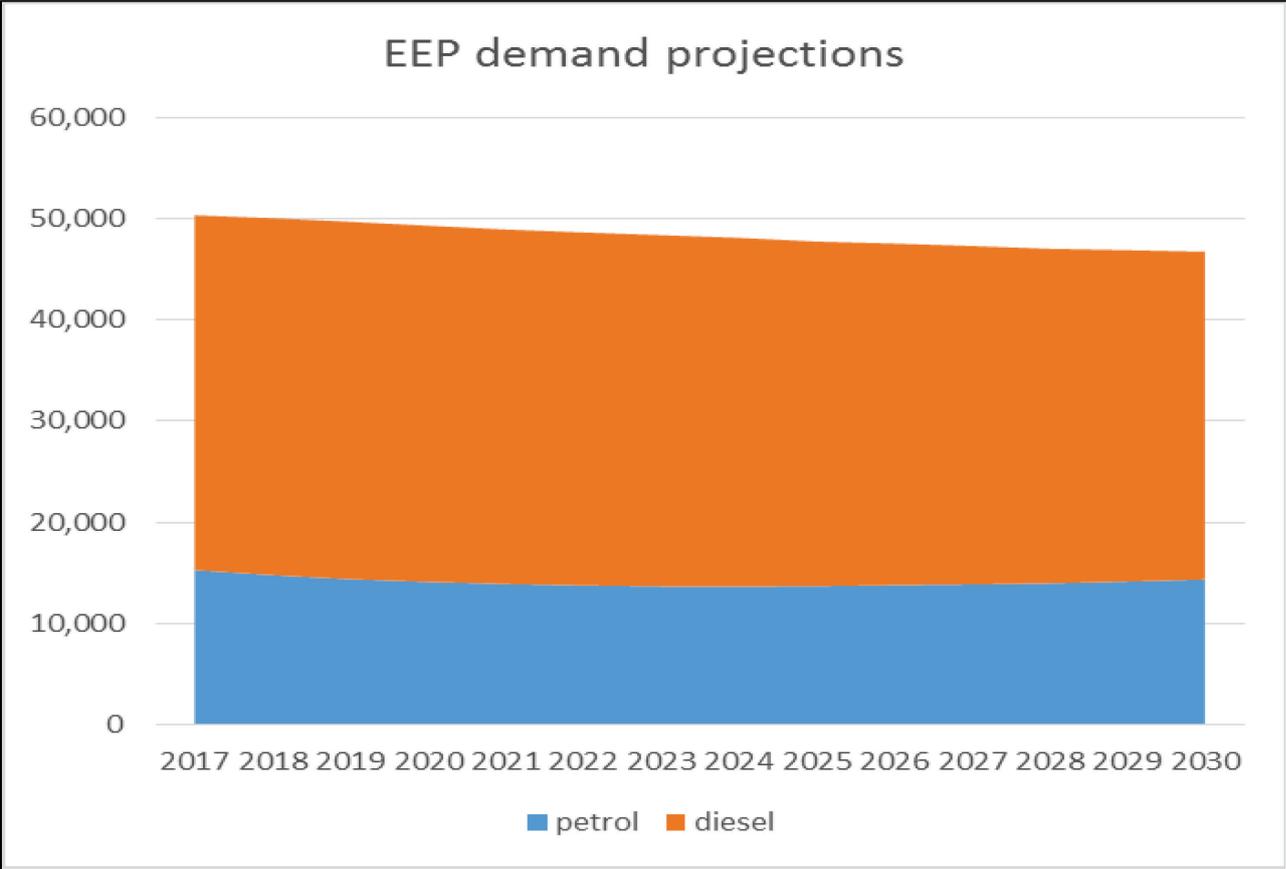
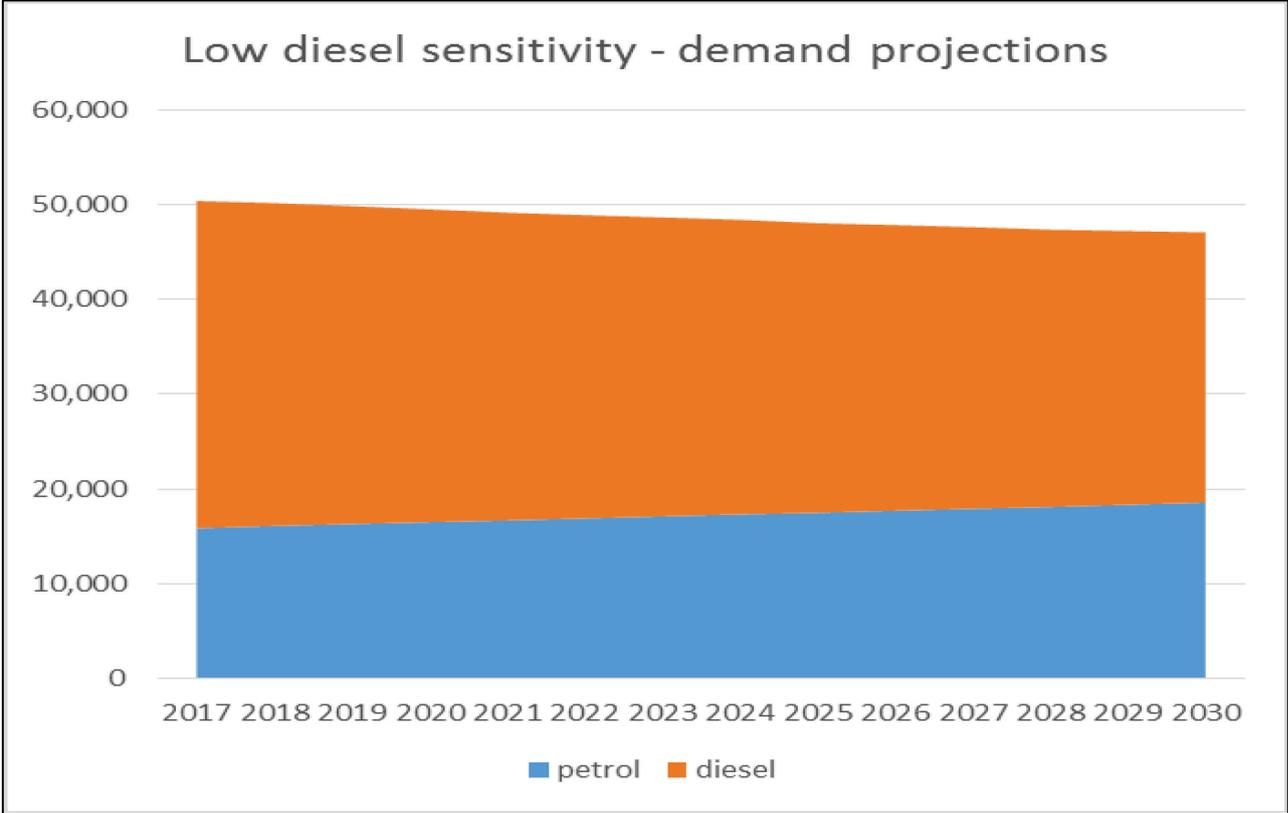


Chart 10: low dieselisation for sensitivity analysis



Energy densities per litre

7.4 For modelling purposes, we use the below energy densities.

Table 20: energy densities of different fuels

Fuel	Energy density (MJ/l)*
Diesel	35.77
Petrol	32.95
Ethanol	21.28
Biodiesel	32.8
Biomethane	50
Biomethanol	16

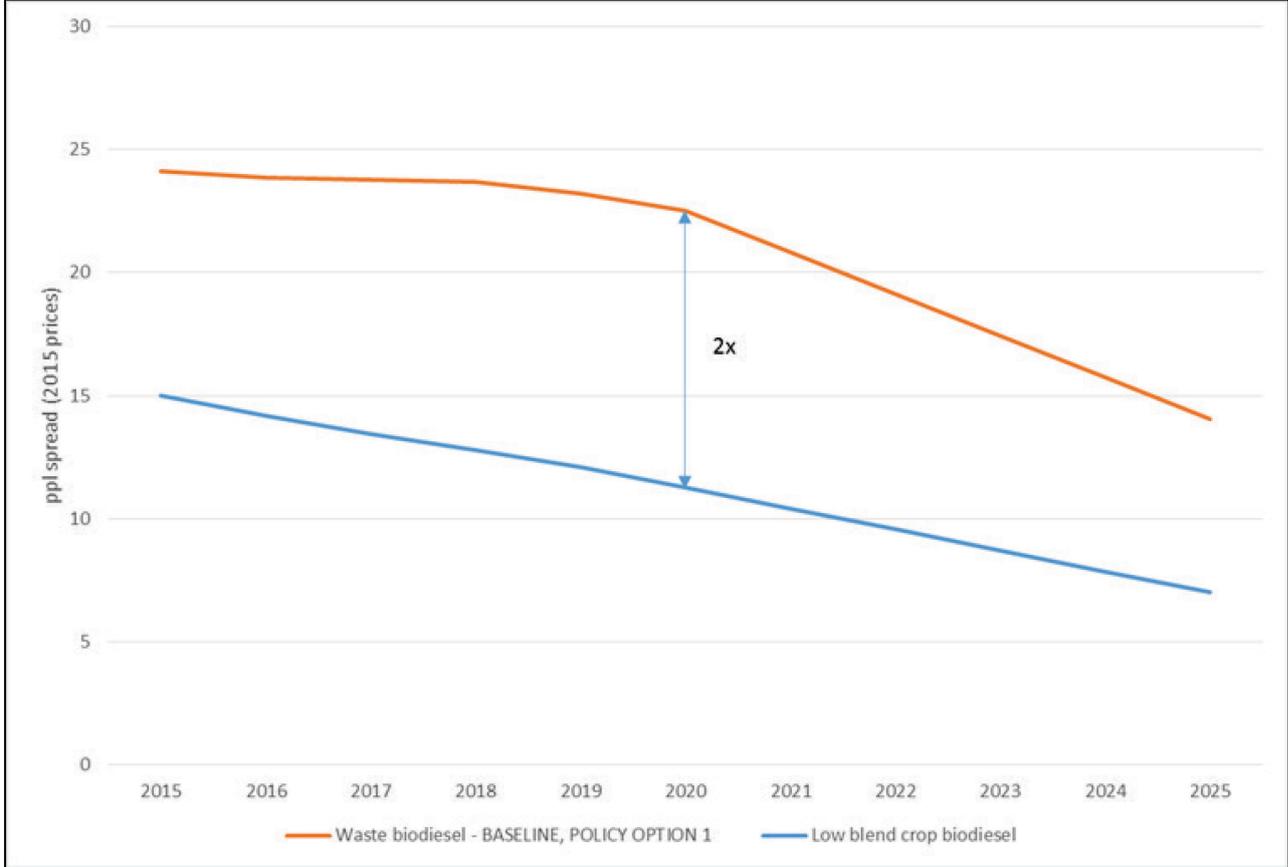
*MJ/kg for biomethane

Source: Annex 2, DTI 'Technology Status Review and Carbon Abatement Potential of Renewable Transport Fuels in the UK', http://www.fcrn.org.uk/sites/default/files/DTI_Technology_status_review.pdf

Cost projections for renewable fuels supplied under the RTFO

- 7.5 The cost of blending renewable fuels and generating RTFCs depends on the difference in market prices between fossil fuels and renewable fuels, which is why we use the terms "price projections" and "cost projections" interchangeably in this CBA.
- 7.6 Global energy and commodity markets are inherently volatile and future market developments are notoriously difficult to predict. To capture this uncertainty, we have developed low/central/high projections of the price spreads between renewable fuels and fossil fuels. (Charts 12, 14, 16) These are projected independently of the underlying fossil fuel prices and commodity prices.
- 7.7 The low/central/high cost projections were developed for the price spreads between fossil fuels and renewable fuels per unit of energy and reflect different possible future developments of global fossil oil, vegetable oil and ethanol markets. To make them more accessible to the audience, we have also translated these into price projections per litre. (Charts 13, 15, 17)
- 7.8 In our central cost projections, the spreads between fossil fuels and renewable fuels fall steadily, since historically the cost of renewable feedstocks has fallen faster than the cost of fossil fuels. We also consider the possibility of spreads either rising (high cost projections) or falling faster (low cost projections).
- 7.9 Though the majority of our projections predict ethanol will be more expensive than crop biodiesel in energy terms (£/MWh), as the RTFO is a volume-based measure and ethanol has a relatively low energy density, we anticipate ethanol will still be cheaper by volume (p/litre). We expect that generating RTFCs from blending ethanol will therefore remain most cost-effective for suppliers, and ethanol will be supplied in preference to other fuels up to the blendwall (E5 or E10) and subject to the crop cap.
- 7.10 The cost projections for "waste biodiesel" are based on the following: 2015 value based upon observed historical diesel- waste biodiesel spreads. This increases to two times the crop biodiesel spread per litre (not per MWh) in 2020, due to a significant increase in demand for waste biodiesel. From 2020, the waste biodiesel spread tracks the crop biodiesel spread (times 2) over the period to 2030.

Chart 11: waste biodiesel spreads, central projection



7.11 As illustrated in Charts 14 and 15, under the high cost projections, waste biodiesel prices reach the buy out price in 2020 and stay at the buy-out price (in real terms) from then onwards.

7.12 For the purposes of labelling, 'low blend' biodiesel is defined as biodiesel blended into fossil diesel at proportions up to 7%. All biodiesel used in blends above 7% is defined as 'high blend', which is not suitable for all diesel engines, and is modelled with a cost uplift of 9 pence per litre to represent the higher costs of using this fuel. This is a DfT estimate, which has been validated by stakeholders with experience of using high blend biodiesel.

Box1: Central cost projection methodology

Resource cost projections were derived as below:

- 1G crop ethanol – 2015 value based upon observed historical petrol-ethanol spreads with a gradual decline over time reflecting a gradually rising oil price and agricultural productivity improvements which allow supply to keep pace with increased demand without significant agricultural commodity price rises.
- 1G low blend crop biodiesel – 2015 value based upon observed historical diesel-crop biodiesel spreads, with a gradual decline over time reflecting a gradually rising oil price and agricultural productivity improvements which allow supply to keep pace with increased demand without significant agricultural commodity price rises.
- 1G high blend crop biodiesel – low blend crop biodiesel plus 9ppl
- 1G Waste biodiesel - 2015 value based upon observed historical diesel-waste biodiesel spreads. Going forward, it is a function of the crop biodiesel spread per litre, reaching two times the crop biodiesel spread per litre in 2020. Post-2020 it tracks the crop biodiesel spread (2x) over the period to 2032.

Cost projections for waste biodiesel under waste scarcity

- 7.13 These cost projections were developed for the consultation CBA and have not been amended for the final CBA. The methodology is still sound but the description still refers to the three different policy options. We assume throughout the CBA that waste biodiesel prices will follow the "baseline/policy option 1" trajectory, except for the purposes of sensitivity analysis (Table 34).
- 7.14 In principle, we assume that the UK is a price taker for renewable fuels and we assume that the policy will have no impact on their market prices through increasing demand. For sensitivity analysis in the consultation, we considered that at higher levels of UK demand for waste biodiesel, the increase in UK demand resulting from the policy could be sufficient to increase the price of waste biodiesel.
- 7.15 Given that the crop cap is now above 2% for almost the entire duration of the policy, and in line with assumptions used in the consultation CBA, we now use the same cost projections for waste biodiesel that were used for the baseline and for policy option 1 in the consultation CBA.
- 7.16 We also perform a sensitivity analysis around the central scenario where the cost of waste biodiesel increases due to exogenous scarcity.
- 7.17 As shown in section 5, while option 1 results in a significant increase in the demand for waste biodiesel relative to the baseline, fuel suppliers retain flexibility to supply crop biodiesel instead. We assume that the price of waste biodiesel is the same under policy option 1 as in the baseline. Under option 2, the crop cap results in a further small increase in the demand for waste biodiesel relative to option 1. Of itself, we would not expect this increase in demand to be sufficient to increase the price of waste biodiesel. However, under option 2, the low crop cap restricts supplier's ability to use crop biodiesel instead of waste biodiesel. We assume this marginally increases the price of

waste biodiesel paid. For modelling purposes we have assumed a one penny per litre premium.

- 7.18 Under option 3, UK waste biodiesel use increases to 2.16 billion litres, significantly above the 1.7bn litres expected under policy option 2 and above the level at which we expect price increases to set in, reflecting the likelihood of significant supply constraints in meeting this level of demand. There is high uncertainty surrounding how an increase in demand of this scale will affect the price that UK suppliers pay for waste biodiesel.
- 7.19 In assessing the impact of option 3 on prices, we define the concept of a "max scarcity" price of biodiesel. This is defined as being the price of biodiesel that we would see if significant additional demand for waste biodiesel across Europe put pressure on the market and if other EU member states were restricted in their ability to use low blend biodiesel (e.g. by the blend wall). In this situation, the closest substitute for waste biodiesel for some member states would be high blend crop biodiesel and we would expect the international price of waste biodiesel to be driven up to the point where it would cost the same to use one litre of waste biodiesel or two litres of **high blend** crop biodiesel.
- 7.20 In a situation where this "max scarcity" scenario is combined with a low crop cap in the UK, we expect the price to increase above this "max scarcity" price, given that the low crop cap will limit UK suppliers' ability to substitute waste biodiesel for any blend of crop biodiesel. For the purposes of modelling we assume that prices increase to one penny per litre above the "max scarcity" price (represented by the highest price projection in charts 18-21).
- 7.21 Under option 3, we assume that the significant increase in demand for waste biodiesel coupled with a crop cap significantly increase **the likelihood** that the price of waste biodiesel increases to the "max scarcity" price plus a one penny premium. For the purposes of modelling policy option 3, we assume the price spread increases to a point exactly half way between the waste biodiesel price under a low crop cap and no scarcity (baseline plus 1 penny premium) and the "max scarcity" price plus one penny premium.
- 7.22 The waste biodiesel price projections converge for policy options 1, 2 and 3, under the high price projections because they all hit the buy-out price in 2020/21. Beyond 2020, the price projections track the buy-out price and decline, as the buy-out price falls in real terms.

Chart 12: central cost projections for different feedstocks 2015-2030, £/MWh spread over fossil fuels, 2015 prices

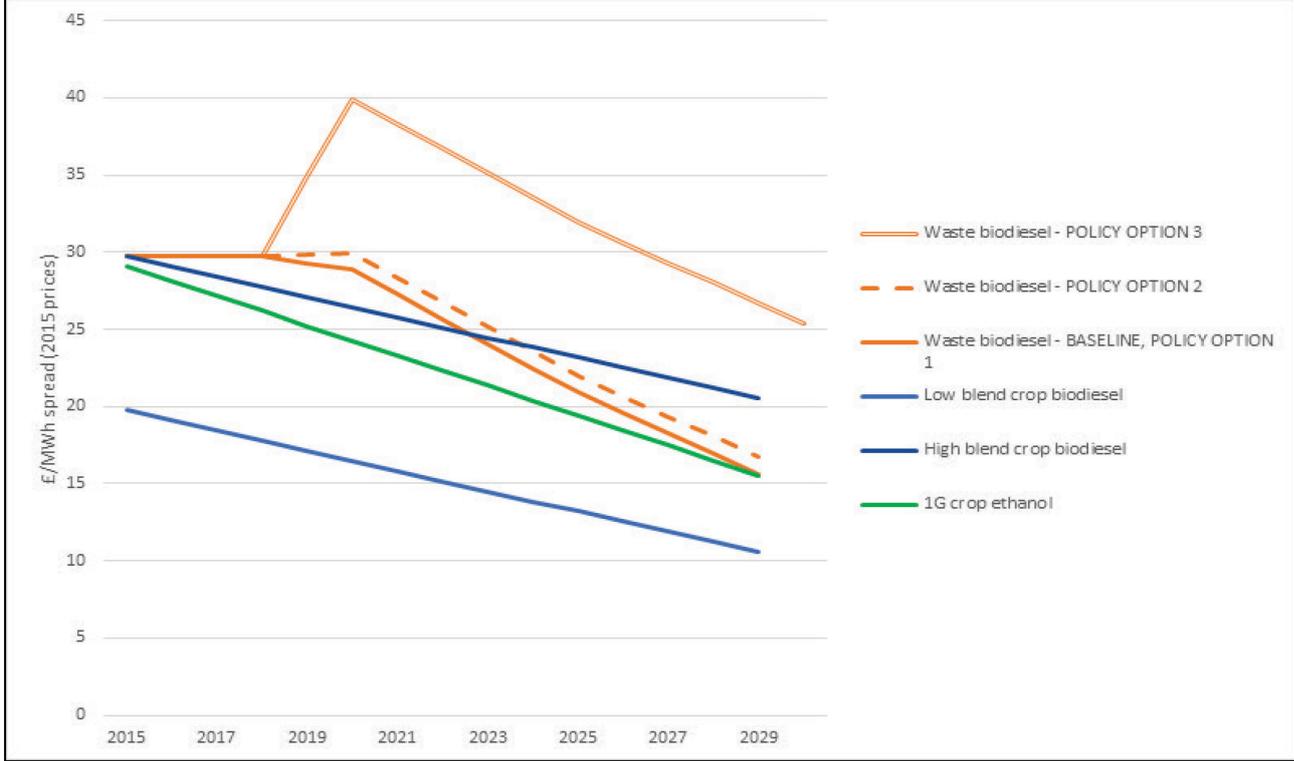


Chart 13: central cost projections for different feedstocks 2015-2030, ppl spread over fossil fuels, 2015 prices

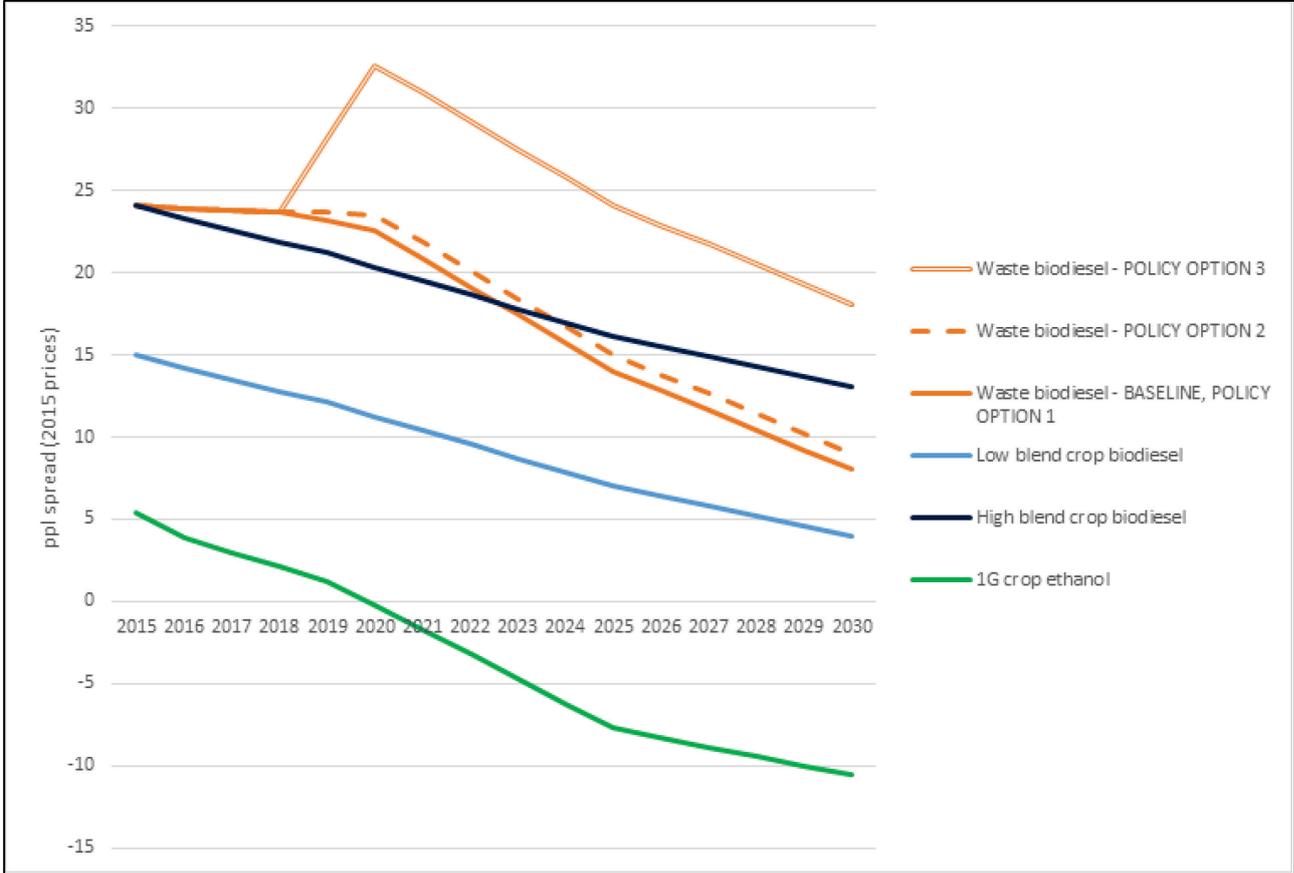


Chart 14: high cost projections for different feedstocks 2015-2030, £/MWh spread over fossil fuels, 2015 prices

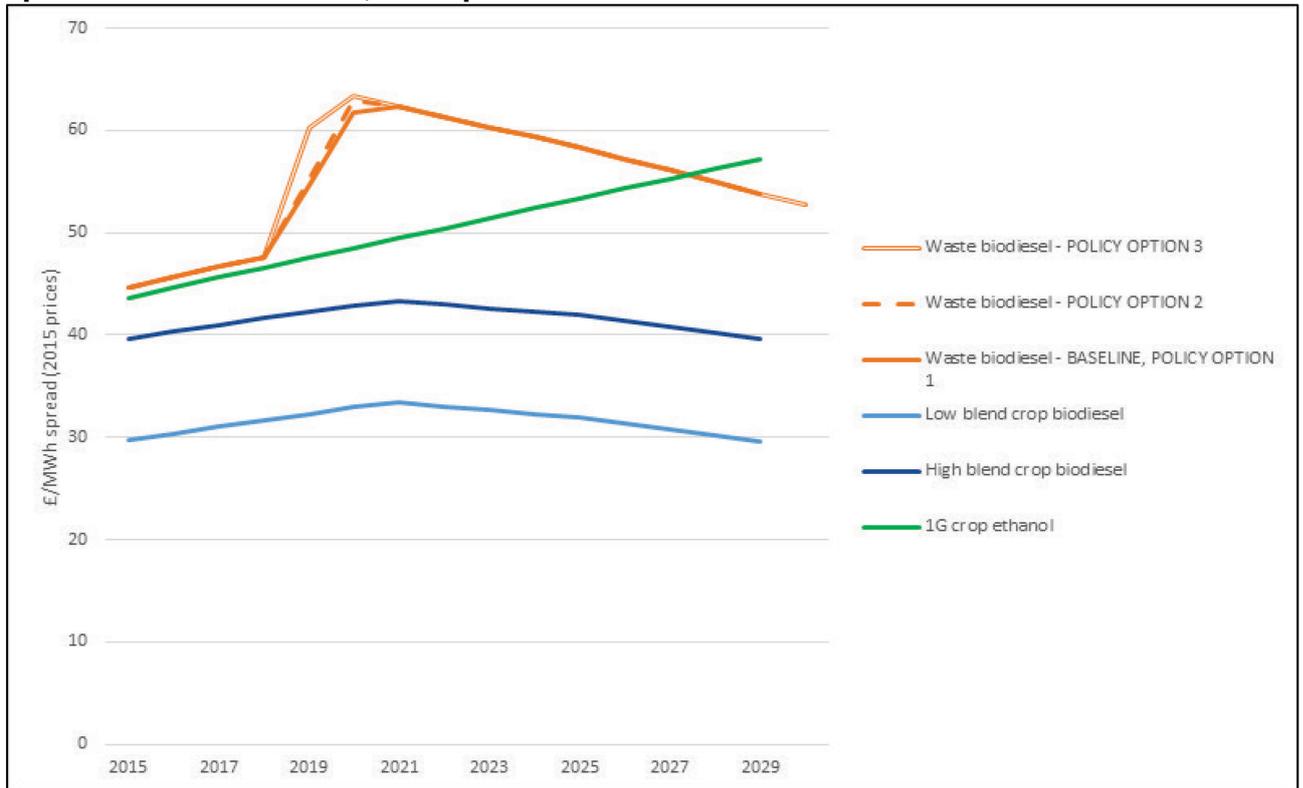


Chart 15: high cost projections for different feedstocks 2015-2030, ppl spread over fossil fuels, 2015 prices

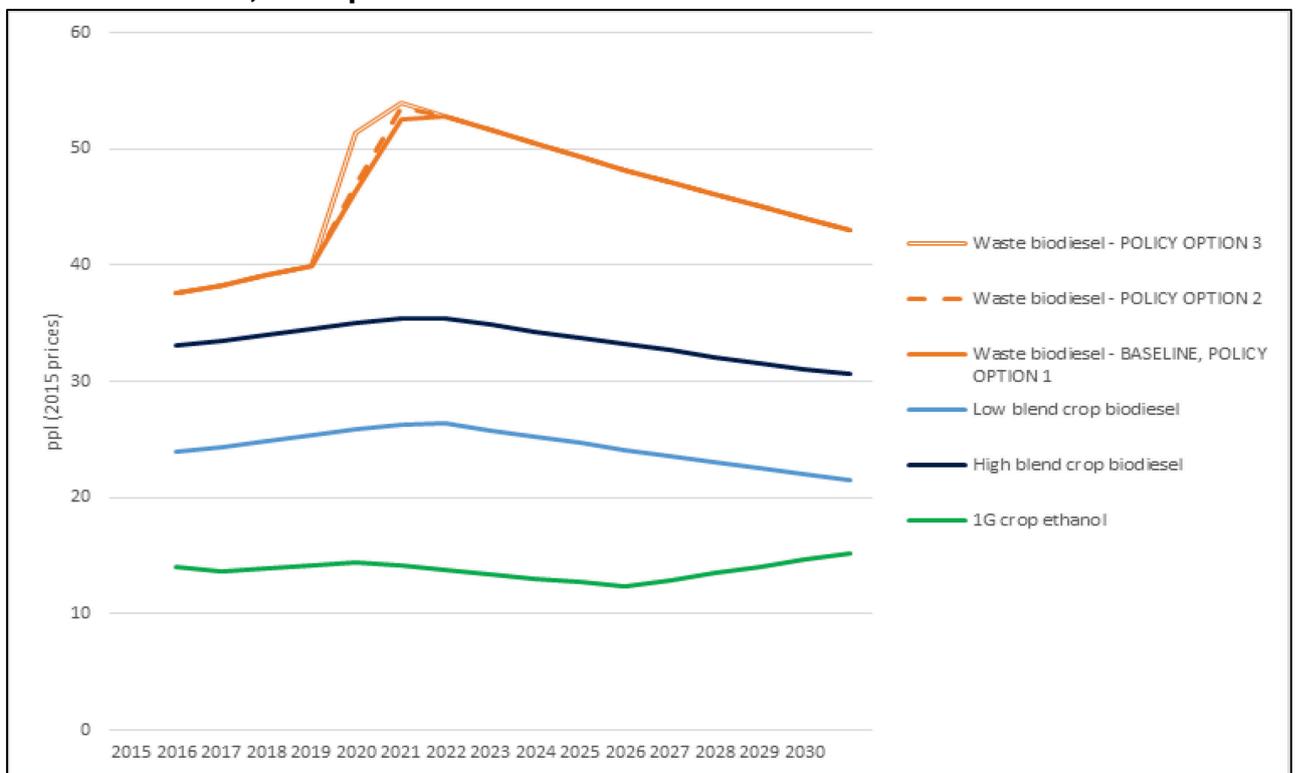


Chart 16: low cost projections for different feedstocks 2015-2030, £/MWh spread over fossil fuels, 2015 prices

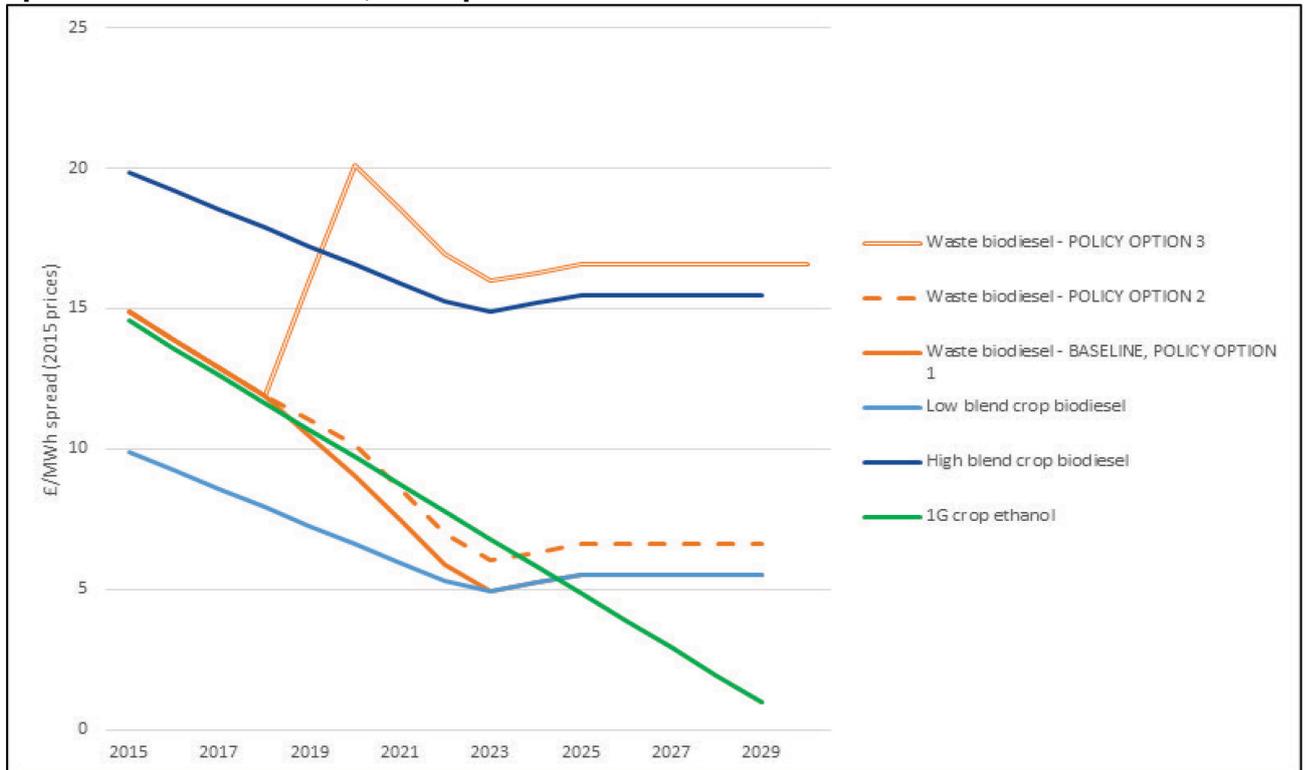


Chart 17: low cost projections for different feedstocks 2015-2030, ppl spread over fossil fuels, 2015 prices

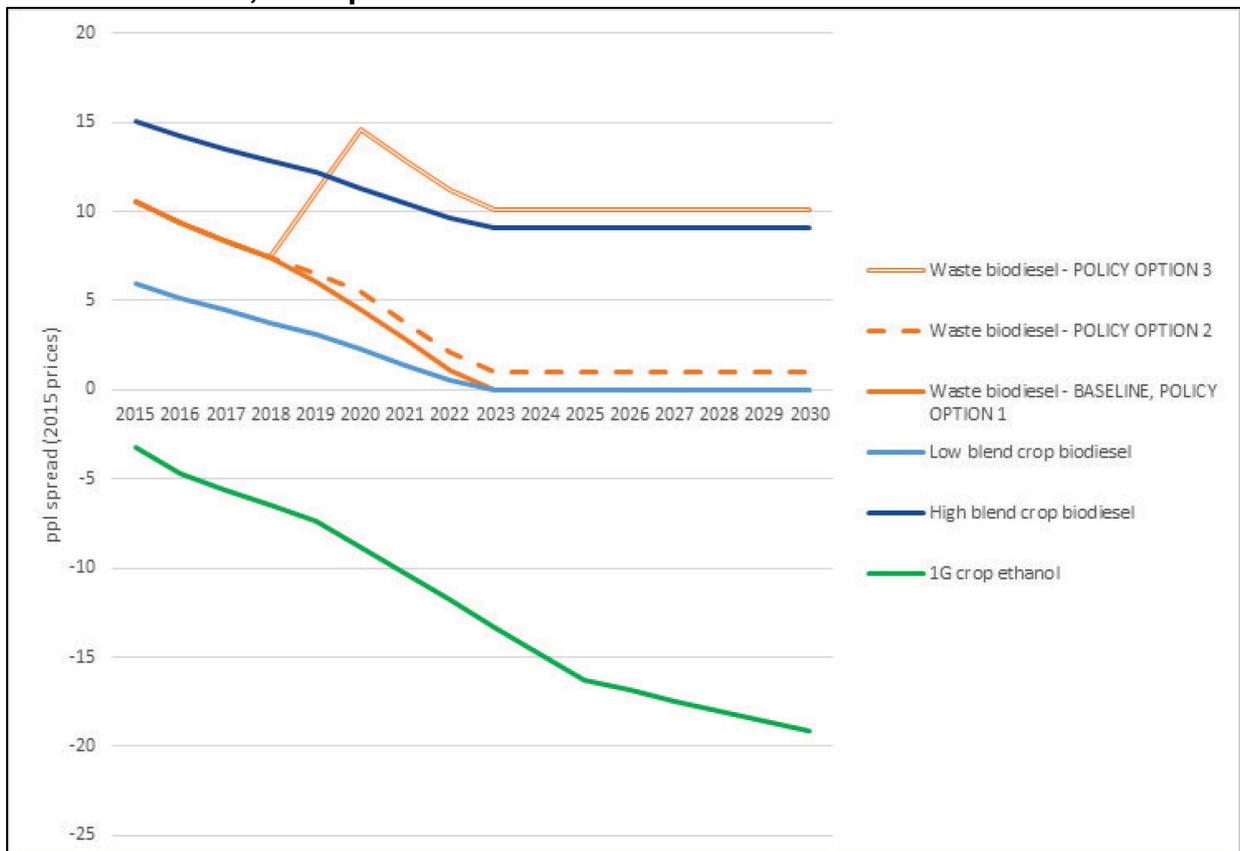


Chart 18: cost projections assuming higher waste biodiesel prices under baseline (£/MWh), 2015 prices

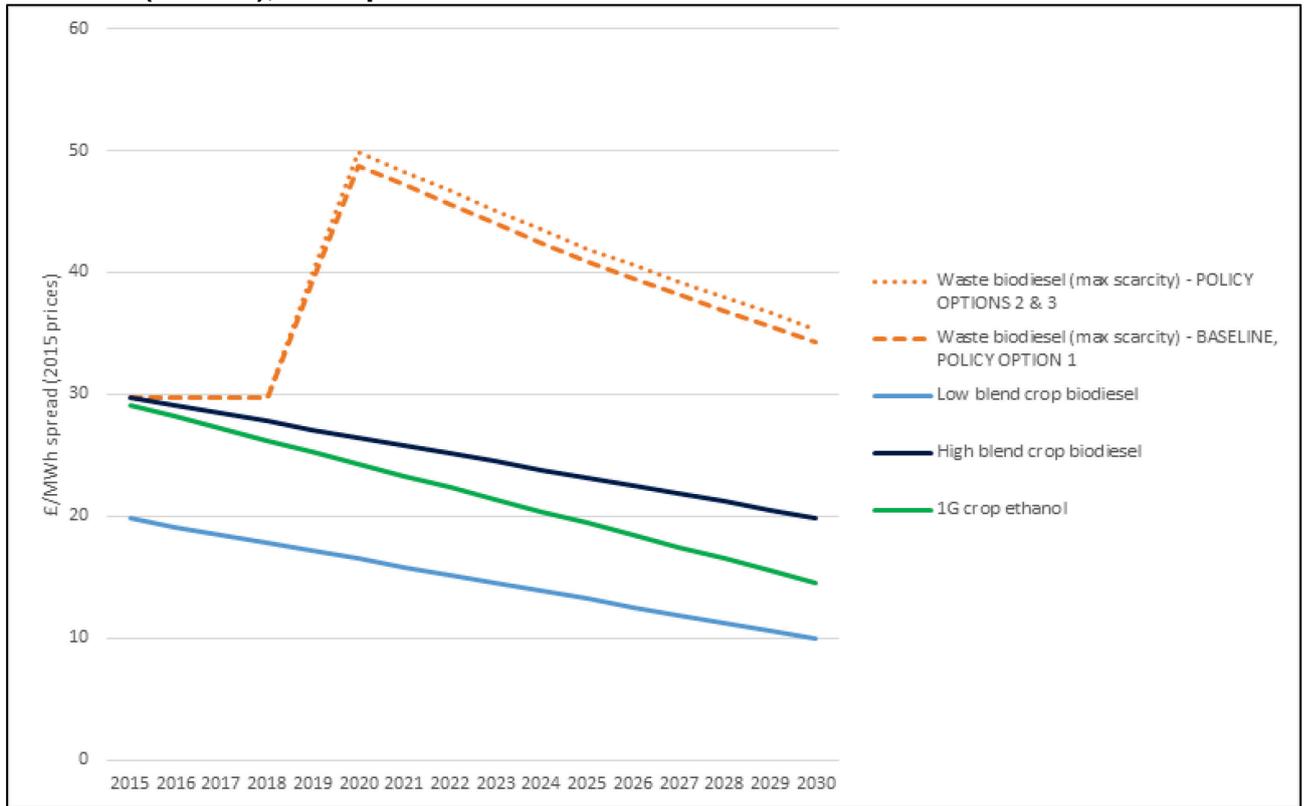
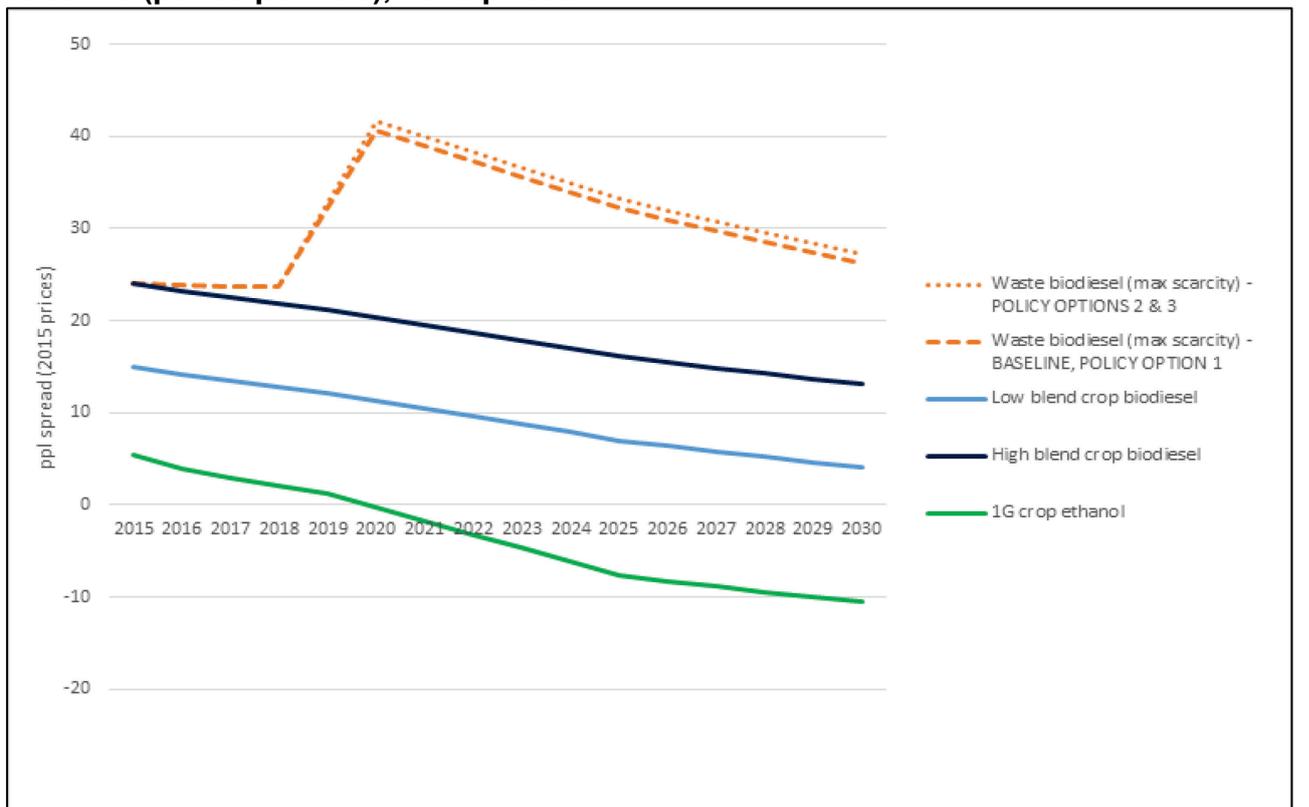


Chart 19: cost projections assuming higher waste biodiesel prices under baseline (pence per litre), 2015 prices



Additional cost projections for waste biodiesel - sensitivity analysis

- 7.23 We have performed two sensitivity tests using alternative assumptions about waste biodiesel prices. The first of these considers the possibility that biodiesel prices are significantly higher than we have assumed for reasons other than the introduction of the policy options considered in this CBA and their impact on UK demand (exogenous price increase). In this scenario we have assumed that the international price of waste biodiesel increases to the "max scarcity" price (see 7.18 above). We also assume that the UK waste biodiesel price increases slightly more under options 2 and 3 as a result of the low crop cap restricting the ability of suppliers to substitute crop biodiesel for waste biodiesel. For modelling purposes, we assume this premium is one penny per litre. The cost projections are set out in charts 18 and 19 below, and the charts show that most of the cost increase also occurs in the baseline.
- 7.24 The second sensitivity considers the possibility that while baseline waste biodiesel prices are as assumed in our central cost projections, the significant increases in UK demand for waste biodiesel resulting from options 2 and 3 result in significantly greater increases in price than we have assumed in our core low, central and high price scenarios (endogenous price increase). For options 2 and 3 we assume that the price of waste biodiesel increases to the "max scarcity" price (as defined in paragraph 7.18) plus a 1 penny premium to account for the low crop cap as above. The cost projections are set out in charts 20 and 21 below, and the charts show that for this sensitivity, most of the cost increase **does not** occur in the baseline.

Chart 20: cost projections assuming higher waste biodiesel prices as a result of policy options (£/MWh), 2015 prices

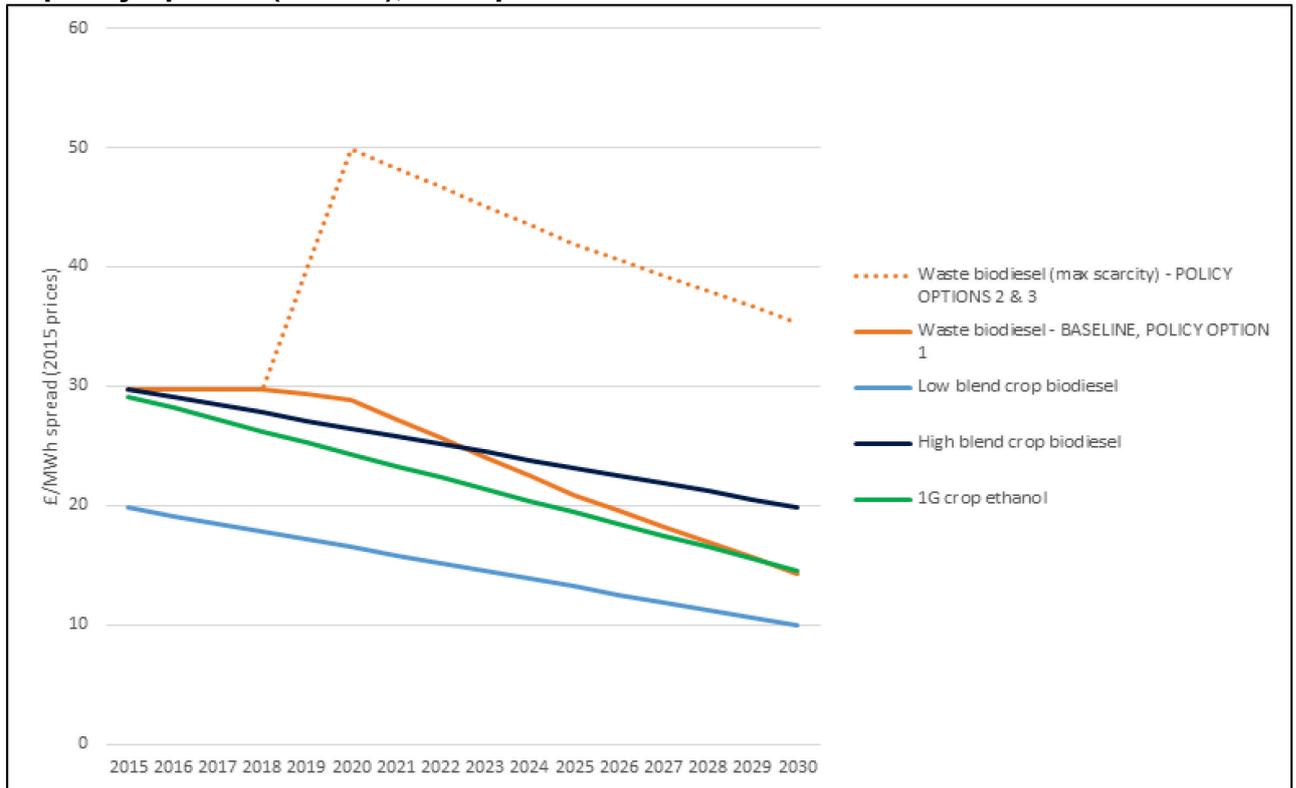
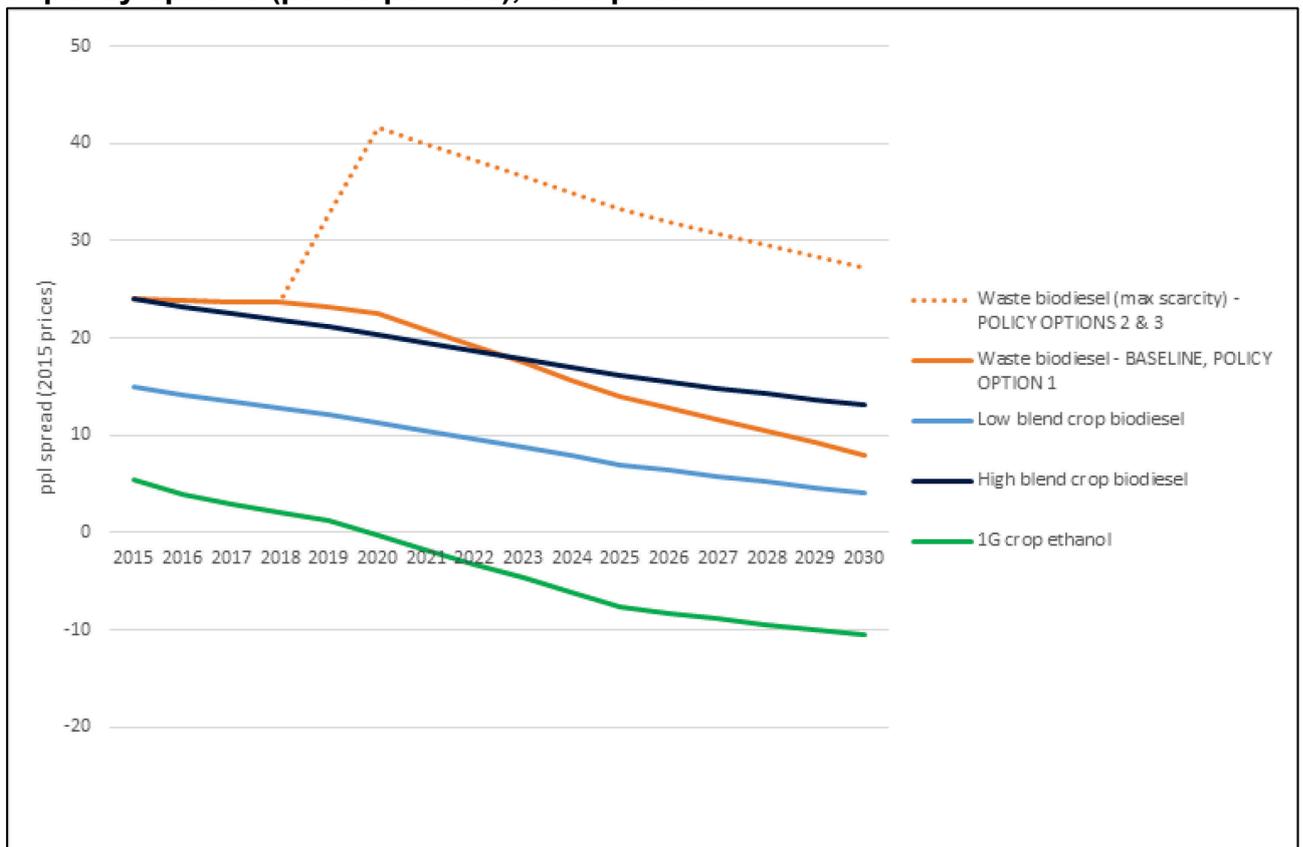


Chart 21: cost projections assuming higher waste biodiesel prices as a result of policy options (pence per litre), 2015 prices



Cost projections for fuels supplied under development fuels sub-target

Chart 22: price projections for fuels supplied under the development sub-target, £/MWh, 2015 prices

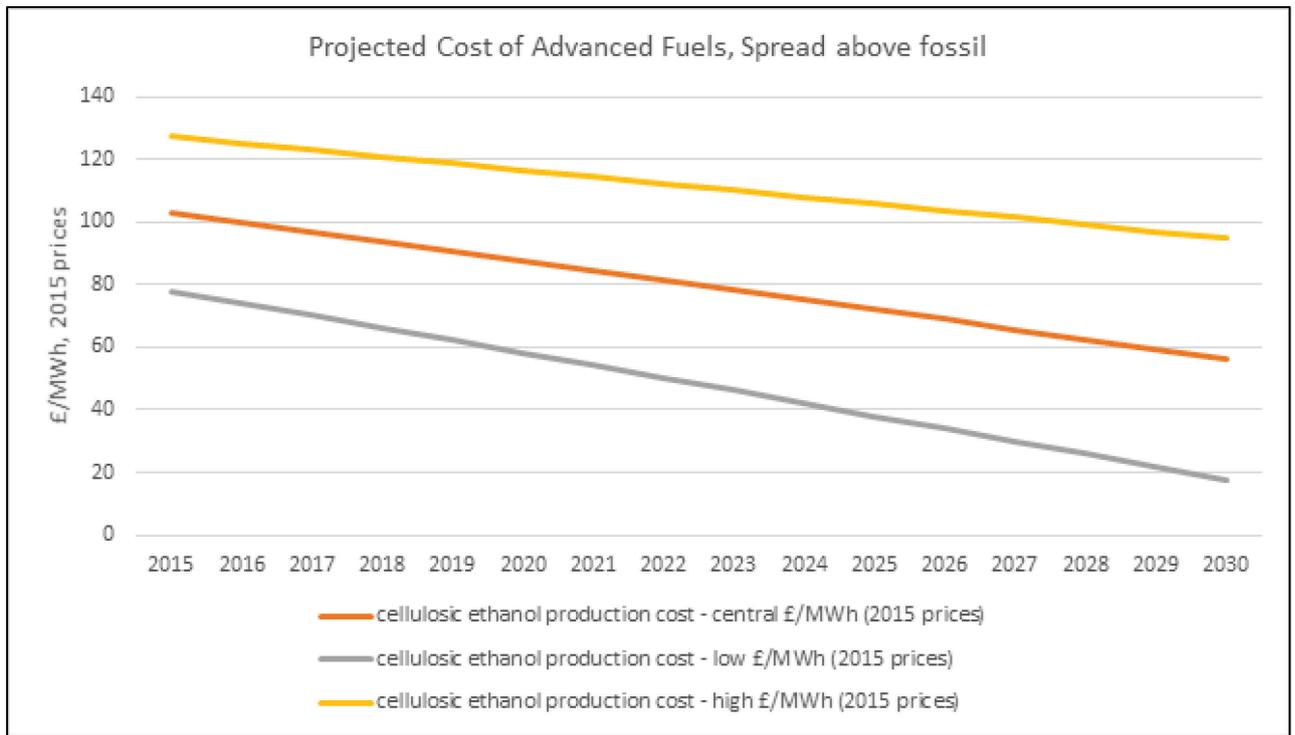
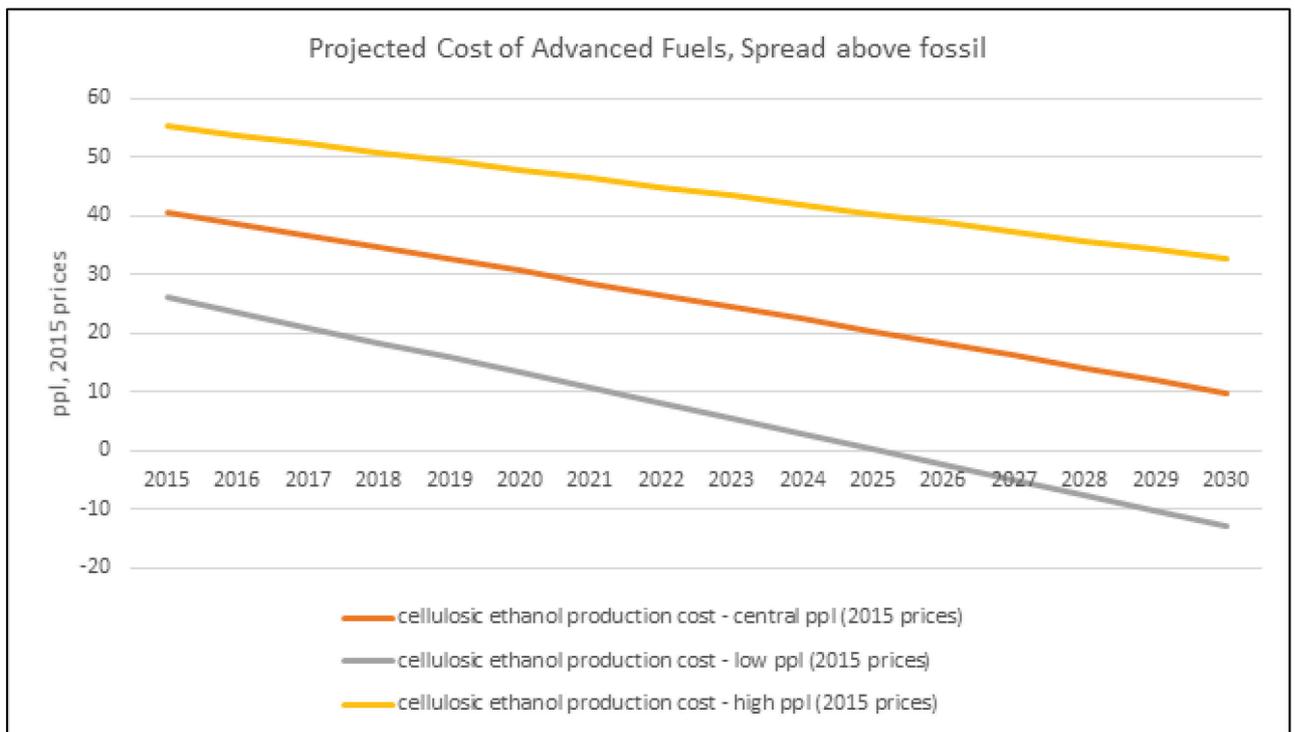


Chart 23: price projections for fuels supplied under the development sub-target, ppl, 2015 prices



7.25 The price projections £/MWh for cellulosic ethanol are also used as a proxy for advanced biodiesel and other waste-derived drop in fuels. Biodiesel has higher energy content per litre, so the price per litre is higher for advanced biodiesel than for cellulosic ethanol. This means we use the supply cost £/MWh of advanced ethanol as a proxy for supply cost of other advanced fuels, due to a lack of other evidence.

Different scenarios for E10 uptake

7.26 For E10, we have three uptake scenarios in 2020 (with gradual ramp up from 2017 to 2020 and constant from 2020 onwards).

Uptake scenario: effective ethanol blend across all petrol used:

No E10, current levels:	E 4.6
High E10: (85% E9.8 + 15% E4.6)	E 9.05
Mid-point, central scenario: (59.5% E4.6 + 40.5% E9.8)	E 6.825

7.27 Contribution of electricity to meeting the RED sub-target:

We assume approximately 300,000 electric road vehicles in the UK in 2020, and that 40% of total energy used in rail comes from electricity. These come from BEIS's Energy and Emissions Projections 2015. Based on the RED, we assume the default value of 30% of this energy being from renewable sources. Based on the EEP electricity and total transport energy demand figures and methodology provided by the RED¹², the contribution of electric rail and vehicles towards the RED is projected to be 4.77TWh or 1.1% of transport energy demand in 2020.

Table 21: contribution of electricity to meeting the RED Target, TWh

TWh		2017	2018	2019	2020
Total demand	Rail	4.50	5.17	5.20	5.23
	Road	0.21	0.31	0.43	0.56
	Total	4.71	5.47	5.62	5.79
Conversion factors Demand ► contribution	Rail	30% from renewable, x 2.5 (multiplier)			
	Road	30% from renewable, x 5(multiplier)			
RED contribution	Rail	3.37	3.88	3.90	3.92
	Road	0.31	0.46	0.64	0.85
	Total	3.68	4.34	4.54	4.77

¹² Article 3, paragraph 4, point c, page 14 of the amendments document:
<http://eur-lex.europa.eu/legal-content/EN/TEXT/PDF/?uri=CELEX:32015L1513&rid=2>

Fuels supplied under the development sub-target

Table 22: Development fuels supplied

	Estimated Certificate Obligation	Biodiesel/ Kerosene/ Millions of litres
2018		
2019	50	25
2020	74	37
2021	246	123
2022	391	195
2023	486	243
2024	581	290
2025	672	336
2026	765	383
2027	857	428
2028	947	473
2029	1038	519
2030	1129	565
2031	1219	610
2032	1311	656

Biomethane is in the model but does not count toward the development sub-target

Table 23: central biomethane uptake scenario

	2014	2015	2016	2017	2018	2019	2020
No. of gas HGVs in fleet, 12.5% of fuel is biomethane	500	1650	2800	3950	5100	6250	7400
Energy from biomethane, TWh	0.02	0.05	0.09	0.13	0.17	0.21	0.24

Assumed carbon intensity of different fuels

7.28 Carbon intensity of fossil fuels:

Table 24: carbon intensity of fossil fuels gCO₂/MJ

Fuel Type	Emissions (gCO ₂ /MJ)
Petrol	93.3
Diesel	95.1
Gas	74.5

Petrol/diesel GHG intensities are based upon Fuel Quality Directive default values - http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu/about-jec/files/documents/report_2014/wtt_appendix_4_v4a.pdf

Gas GHG intensities are taken from European Commission's JRC Well-to-Wheels report (GRLG1), April 2014 - http://iet.jrc.ec.europa.eu/about-jec/sites/iet.jrc.ec.europa.eu/about-jec/files/documents/report_2014/wtt_appendix_4_v4a.pdf

7.29 Carbon intensity of renewable fuels:

Table 25: carbon intensity of renewable fuels gCO₂/MJ

Fuel Type	Total Ems (gCO ₂ /MJ)	Direct Ems (gCO ₂ /MJ)	Indirect Ems (gCO ₂ /MJ)
1G waste biodiesel (UCO)	14.9	14.9	0.0
1G waste biodiesel (tallow)	72.9	14.9	58.0
1G crop biodiesel	96.8	42.0	54.8
2G advanced biodiesel (land using)	21.0	6.0	15.0
2G advanced biodiesel (non land using)	4.0	4.0	0.0
1G waste ethanol	29.2	29.2	0.0
1G crop ethanol	47.0	35.5	11.5
2G advanced ethanol (land using)	35.0	20.0	15.0
2G advanced ethanol (non land using)	17.0	17.0	0.0
Biomethane	21.4	21.4	0.0
Biomethanol	36.1	36.1	0

1st generation biofuel emissions (direct) are based upon historical RTFO data (from year 4b onwards) - <https://www.gov.uk/government/collections/biofuels-statistics>

2nd generation biofuel emissions (direct) have been taken from Renewable Energy Directive, Annex V, Part E - <http://faolex.fao.org/docs/pdf/eur88009.pdf>

1st generation crop biofuel emissions (indirect) and 2nd generation biofuel emissions (indirect) have been taken from the European Commission ILUC impact assessment - <http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014SC0127&from=EN>

1st generation tallow biodiesel emissions (indirect) have been taken from Ecofys research http://webarchive.nationalarchives.gov.uk/20110407094507/http://www.renewablefuelsagency.gov.uk/sites/rfa/files/_documents/Appendix_7_-_Tallow_Case_Study_200912231729.pdf

7.30 We recognise that for zeros, biofuels are assumed to have zero carbon emissions associated with them

Valuing carbon savings

7.31 To estimate the value of carbon saved, we have used non-traded carbon values as laid out in Green Book supplementary guidance

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/483278/Valuation_of_energy_use_and_greenhouse_gas_emissions_for_appraisal.pdf

Table 26: carbon prices and sensitivities for appraisal, 2015 £/tCO₂e

	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
Low	31	32	32	33	33	34	34	35	35	36	36
Central	62	63	64	65	66	67	68	69	71	72	73
High	94	95	96	98	99	101	103	104	106	108	109

Appendix 2 - Share of renewable fuels supplied by volume and by energy

Renewable fuels supplied, share of total volume with policy

Table 27: renewable fuels as share of fuels by volume, with policy

Fuels supplied, share of total by volume	1G Ethanol (= crop share)	1G Waste biodiesel	Advanced fuels*	Total
2018	1.65%	2.58%	0.20%	4.43%
2019	1.79%	3.12%	0.21%	5.12%
2020	1.92%	3.64%	0.24%	5.81%
2021	1.91%	3.65%	0.42%	5.97%
2022	1.90%	3.65%	0.57%	6.12%
2023	1.90%	3.65%	0.67%	6.22%
2024	1.91%	3.65%	0.77%	6.32%
2025	1.92%	3.64%	0.87%	6.43%
2026	1.95%	3.63%	0.97%	6.54%
2027	1.97%	3.62%	1.07%	6.65%
2028	1.99%	3.61%	1.17%	6.77%
2029	2.03%	3.59%	1.27%	6.88%
2030	2.06%	3.57%	1.36%	7.00%
2031	2.09%	3.56%	1.46%	7.12%
2032	1.98%	3.47%	1.72%	7.16%

*includes waste derived ethanol as well as fuels delivered under the development sub target

Table 28: renewable fuels as share of fuels by energy, with policy

By energy as % share of fuel supply under RED definition	1G Ethanol**	1G Waste biodiesel	Advanced	Total	Total with double rewarding
2018	1.11%	2.66%	0.16%	3.93%	6.75%
2019	1.20%	3.22%	0.17%	4.59%	7.99%
2020	1.29%	3.76%	0.21%	5.26%	9.23%
2021	1.28%	3.77%	0.39%	5.44%	9.60%
2022	1.27%	3.78%	0.54%	5.60%	9.92%
2023	1.27%	3.78%	0.65%	5.70%	10.13%
2024	1.28%	3.78%	0.75%	5.81%	10.33%
2025	1.29%	3.77%	0.85%	5.92%	10.54%
2026	1.31%	3.75%	0.96%	6.02%	10.73%
2027	1.32%	3.75%	1.06%	6.13%	10.93%
2028	1.34%	3.73%	1.16%	6.24%	11.13%
2029	1.36%	3.72%	1.27%	6.35%	11.33%
2030	1.33%	3.59%	1.68%	6.60%	11.87%
2031	1.32%	3.55%	1.80%	6.67%	12.01%
2032	1.32%	3.51%	1.92%	6.76%	12.19%

** From 2020 onward, this assumes 59.5% of E5 and 40.5% of E10 on average across the entire petrol supply, i.e. an overall ethanol content of 6.825%

Appendix 3 - Total volumes of renewable fuels supplied

Baseline volumes

Table 29: Total volumes Baseline

Total volumes of renewable fuel	1G Ethanol (million litres)	Waste biodiesel (million litres)	Other, including biomethane (million litres/kgs)	Total (million litres)
2018	662	754	101	1538
2019	643	750	104	1517
2020	631	742	106	1497
2021	621	738	106	1479
2022	615	734	106	1465
2023	611	730	106	1455
2024	610	724	106	1447
2025	611	714	106	1440
2026	616	707	106	1432
2027	619	700	106	1429
2028	624	691	106	1425
2029	633	683	106	1421
2030	642	675	106	1422
2031	650	668	106	1423
2032	661	662	106	1424

With policy, central E10

Table 30: total volumes of renewable fuels supplied

Total volumes of renewable fuel	1G Ethanol (million litres)	1G Waste biodiesel (million litres)	Other, including development fuels (million litres/kgs)	Total (million litres)
2018	835	1302	101	2237
2019	897	1564	107	2568
2020	958	1813	122	2893
2021	944	1804	207	2954
2022	934	1795	279	3008
2023	928	1786	327	3041
2024	926	1775	373	3075
2025	929	1757	419	3105
2026	936	1744	465	3145
2027	941	1732	510	3183
2028	948	1716	555	3219
2029	961	1703	600	3265
2030	974	1690	645	3310
2031	987	1679	690	3356
2032	931	1634	808	3372

Appendix 4 - NPVs sensitivity analysis scenarios

7.32 In these scenarios, all else remains central except the variable for which the sensitivity is being tested

Table 31: NPVs for High E10

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	164	83	18	-62
2019	233	122	26	-85
2020	300	159	35	-105
2021	323	169	46	-108
2022	337	177	54	-106
2023	334	180	59	-95
2024	328	184	63	-82
2025	320	186	66	-68
2026	312	189	69	-54
2027	303	191	72	-40
2028	294	192	76	-26
2029	294	191	83	-19
2030	291	191	90	-11
2031	304	205	96	-4
2032	317	218	102	2
Total	4455	2638	954	-864

Table 32: NPVs for No E10

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	157	86	14	-57
2019	225	126	21	-78
2020	291	164	28	-98
2021	314	174	39	-100
2022	328	182	48	-98
2023	324	185	53	-86
2024	318	188	57	-73
2025	309	190	60	-59
2026	302	193	64	-45
2027	293	195	67	-31
2028	282	197	70	-15
2029	270	199	72	1
2030	258	201	75	18
2031	263	218	77	31
2032	269	234	78	43
Total	4201	2732	823	-647

Table 33: NPVs for high crop biodiesel uptake

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	189	-10	3	-196
2019	248	49	13	-187
2020	302	127	27	-148
2021	326	138	38	-150
2022	340	147	47	-146
2023	336	151	52	-133
2024	330	156	56	-119
2025	322	160	60	-102
2026	314	164	63	-86
2027	304	168	67	-69
2028	292	174	70	-48
2029	279	183	73	-22
2030	264	192	76	3
2031	267	215	79	26
2032	278	231	84	37
Total	4390	2245	807	-1338

Table 34: NPVs for waste biodiesel scarcity scenario, high global demand

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	160	85	16	-59
2019	295	124	24	-147
2020	462	162	31	-268
2021	478	172	43	-264
2022	486	179	51	-256
2023	477	183	56	-239
2024	465	186	60	-220
2025	451	188	63	-200
2026	438	191	67	-181
2027	424	193	70	-161
2028	408	195	72	-140
2029	391	197	75	-120
2030	374	199	77	-98
2031	374	216	79	-79
2032	378	231	84	-63
Total	6062	2701	866	-2495

Table 35: NPVs for low dieselisation scenario

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	161	85	16	-60
2019	231	124	24	-82
2020	297	162	32	-103
2021	321	172	43	-105
2022	335	180	52	-104
2023	332	183	57	-92
2024	326	186	61	-79
2025	318	189	64	-65
2026	311	192	68	-51
2027	301	194	71	-37
2028	290	196	74	-21
2029	287	196	80	-12
2030	284	195	86	-3
2031	296	210	91	6
2032	306	224	96	14
Total	4398	2689	916	-793

Table 36: NPVs for GLOBIOM ILUC factors

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	160	82	16	-62
2019	229	121	24	-85
2020	295	157	31	-106
2021	318	167	43	-109
2022	332	175	51	-106
2023	329	178	56	-95
2024	323	182	60	-82
2025	314	184	63	-67
2026	307	187	67	-54
2027	298	189	70	-39
2028	287	191	72	-23
2029	275	193	75	-7
2030	263	195	77	10
2031	267	212	79	24
2032	278	228	84	34
Total	4276	2641	866	-768

Table 37: NPVs for carbon budget carbon accounting

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	160	121	16	-23
2019	229	177	24	-28
2020	295	230	31	-34
2021	318	239	43	-37
2022	332	246	51	-35
2023	329	249	56	-25
2024	323	251	60	-12
2025	314	252	63	1
2026	307	254	67	14
2027	298	256	70	28
2028	287	257	72	42
2029	275	258	75	58
2030	263	259	77	74
2031	267	281	79	93
2032	278	296	84	102
Total	4276	3627	866	218

Table 38: NPVs for low carbon values

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	160	42	16	-102
2019	229	62	24	-143
2020	295	81	31	-183
2021	318	86	43	-190
2022	332	90	51	-192
2023	329	91	56	-182
2024	323	93	60	-170
2025	314	94	63	-157
2026	307	95	67	-145
2027	298	97	70	-132
2028	287	97	72	-117
2029	275	99	75	-102
2030	263	99	77	-86
2031	267	108	79	-80
2032	278	116	84	-78
Total	4276	1350	866	-2059

Table 39: NPVs for high carbon values

£m, 2015 prices	Resource cost	Total carbon benefits	Total industry VA benefits	Net cost/benefit
2018	160	127	16	-17
2019	229	186	24	-19
2020	295	243	31	-21
2021	318	258	43	-18
2022	332	269	51	-12
2023	329	274	56	1
2024	323	279	60	15
2025	314	282	63	31
2026	307	286	67	46
2027	298	290	70	61
2028	287	292	72	78
2029	275	296	75	95
2030	263	298	77	113
2031	267	324	79	136
2032	278	347	84	153
Total	4276	4051	866	642

Sensitivity analysis for carbon abatement cost estimates**Table 40: carbon abatement cost estimates for sensitivity scenarios**

PRE-CONSULTATION Average abatement cost, present value (£/TCO ₂ e) 2017-30	Central assumptions	Low waste/ high crop	GLOBIOM ILUC values	Carbon Budget Accounting
Option 2	95	128	98	N/A
POST-CONSULTATION Average abatement cost, present value (£/TCO ₂ e) 2018-32				
Central scenario	119	N/A	122	88

Appendix 5 - Summary of consultation responses

Question 45: Do you have any evidence on the supply cost of 'development fuels' or any other evidence that could inform the level of the buy-out price?

Summary of responses

Total	Yes	No
28	10	18

7.33 We received 28 responses to this question, 10 "yes" and 18 "no" responses. Several respondents ticked "no" and then expressed views on the level of the buy-out price.

- There was a prevailing view from a range of different respondents that a high buy out price would be required to support the large capital investments needed for development fuels.
- Several respondents pointed out that the volatility of RTFC prices limits their "bankability", which is necessary to attract capital investors.
- A number of renewable fuel suppliers expressed the view that there would be little risk of over-rewarding development fuel suppliers with a high buy out price. If the buy-out price is too high it would lead to oversupply, this would result in the obligation being exceeded and allow the market to set the correct support price.
- The idea of a development sub-target was opposed by several fossil fuel suppliers who instead suggested development fuels should receive multiple (three to four) RTFCs per litre.

7.34 Out of the ten respondents who ticked "yes", three provided supply cost estimates for relevant fuels:

- One industry representative body estimated that the buy-out price would need to be at least 55 pence per certificate to match the support biomethane from AD receives under the RHI.
- One renewable fuel supplier estimated that the supply cost of syngas would require a buy-out price above 30 pence per certificate, assuming that syngas is awarded 3.8 certificates per kg.
- One renewable fuel supplier estimated that the buy-out price would need to be at least 60 pence per certificate for waste-derived biomethane to be supplied and that advanced biodiesel and jet fuel would require a much higher buy-out price.

7.35 In addition, support for a high development fuel buy-out price was expressed by three industry representative bodies, one road freight sector operator and seven renewable fuel producers/suppliers and one fossil fuel producer/supplier. This includes one industry representative body and two renewable fuel producer/suppliers who suggest the need for floor price support, i.e. a minimum value for development RTFCs.

7.36 Arguments in support of a high buy out price include the high capital cost of development fuel plants and views on future diesel and gas prices. Equally, a

floor price for development RTFCs was suggested as a way to overcome the volatility of RTFC prices, which means they are not “bankable” and do not guarantee the minimum return that capital investors would require. One industry representative body illustrated how the certain revenue from the RHI was preferable to a biomethane producer over the uncertain revenue from RTFCs. Regarding the floor price, it was suggested that this should be based on a carbon damage cost of £70 per tonne of carbon-dioxide equivalent, quoting from a 2010 publication by HMT “Carbon Price Floor”. They also suggest that cost neutrality could be achieved by using revenues from buy-out to compensate suppliers when the market price falls below the floor price.

- 7.37 One renewable fuel supplier suggested that high blends of biofuels should be rewarded under the development sub-target including all Annex IX or waste feedstocks, since this would ensure sufficient volumes are available and that in this case no buy-out mechanism would be needed. Their argument is that this would prevent a situation where high buy-out costs are incurred without achieving any carbon savings.
- 7.38 One consultant suggested that the buy-out price should be set according to what is "a reasonable amount to spend in £/t CO₂ on decarbonation of transport fuels, compared to other climate change mitigation options."
- 7.39 One industry representative body suggested that cost neutrality could be achieved through a combination of a floor price and a mechanism akin to the Contract for Difference strike price. In this case, when the RTFC market price is below the floor price, payments would be made to fuel suppliers to make up the difference, but when the market price is above the buy-out price any payments made to fuel suppliers when the market price was below would be deducted from above floor price revenue and paid to Treasury.

Government response

- 7.40 The consultation responses have been very helpful in confirming that both a high buy-out price and a tight definition of fuels qualifying under the development sub-target are required to improve the bankability of dRTFCs and stimulate investment in this new industry.

Question 46: Do you agree with the approach taken to calculating net value added to the economy by UK biofuel production?

Summary of responses

Total	Yes	No
30	15	15

- 7.41 We received 30 responses to this question. Fifteen respondents agreed with the approach taken and 15 disagreed.
- 7.42 Six fossil fuel suppliers disagreed with the approach taken, suggesting that the methodology used failed to consider the costs to other impacted sectors. It was argued that increasing the biofuel blend in UK transport fuels would displace fossil fuels, putting greater pressure on UK refineries. This would result in

further refining capacity reductions and closures which would have a negative impact on the economy and employment.

- 7.43 One fossil fuel supplier identified that the large positive and negative range highlighted the uncertainty surrounding any economic impact.
- 7.44 Renewable fuel producers and industry representatives were split between those who thought the methodology was correct (twelve) and those who disagreed and thought it was underestimating the benefits from biofuel production (seven). Those that disagreed argued that the net value added calculations failed to account for indirect impacts which benefited the supply chain other than the biofuel supplier. It was suggested that multiplier benefits would be observed from new employees being hired and those already working in the biofuel industry. Animal feed benefits were claimed to have been omitted, which one respondent stated is a substantial part of the overall benefits to be gained from UK biofuel production.
- 7.45 Renewable fuel producers (and one fossil fuel supplier) who agreed with the government's methodology claimed that the displacement of crop biodiesel with waste biodiesel will cause positive indirect land use change, in addition to other benefits received from increased demand and prices from waste based feedstocks.
- 7.46 One respondent welcomed a specific breakdown of technologies within UK biofuel production as they believe biomethane from anaerobic digestion (AD) has great potential with regards to capital investment, job creation and export potential.
- 7.47 Alternative methodological approaches suggested by respondents included the consideration of non-quantified impacts from cost savings associated with meeting the obligation by double counted fuels (as each litre satisfies the obligation twice as efficiently as a crop derived litre). The fossil fuel supplier in this case argued that this will benefit fuel suppliers due to lower incorporation of physical biofuel and will reduce the movement of physical biofuel litres, saving carbon emissions for transport.
- 7.48 It was also suggested that power to gas systems (P2G) producing SNG as well as next generation technologies such as DIAGEN would add additional value to the economy through innovation.

Government response

- 7.49 The value of animal feed benefits (DDGS) was already included in the CBA. The impacts on the fossil fuel industry are reflected in the "displacement" aspect of our value added methodology.
- 7.50 We have insufficient robust evidence to estimate multiplier effects and other indirect effects of biofuel production. Therefore we have not amended the value added methodology post consultation.

Question 47: Do you have any additional evidence we should consider in estimating the costs and benefits of the policy options?

Summary of responses

Total	Yes	No
25	24	1

- 7.51 We received 24 "yes" responses to this question. Nine respondents from a variety of industries only referred to their answer to Q46, 15 respondents provided additional information.
- 7.52 Twelve respondents comprising seven renewable fuel producers, one fossil fuel supplier, two waste recycling companies and two industry representatives cited the recent change in exchange rates as a factor which should be considered if we were to look at the cost of biofuels and biofuel feedstocks from the UK again (costs have fallen).
- 7.53 Two respondents suggested that additional fuels should be considered (SNG and biomethanol).
- 7.54 One fossil fuel supplier suggested that the UK should aim to reduce GHG emissions at the lowest cost to consumers which may require alternative fuels to be used instead of biofuels.
- 7.55 One renewable fuel producer suggested that the government should use an end-of-life route for treated timber products.
- 7.56 One consultancy made reference to multiple studies which looked into reducing carbon emissions in the production process.

Government response

- 7.57 Regarding the lower value of the pound, this increases the cost of some feedstocks and lowers the cost of others, while all feedstocks continue to be traded in international commodity markets. We have already included high price and low price scenarios in the CBA and we feel that this sufficiently covers the possible cost variations following from exchange rate changes.
- 7.58 Regarding the other information provided, we did not find that there was enough robust evidence to change the CBA methodology.

Q 48- Do you have any evidence of waste feedstock availability to 2020 and how markets are likely to react to increased demand in the run up to 2020?

Summary of responses

Total
45

- 7.59 We received 45 responses from a wide range of stakeholders. There were three distinct themes in the responses:

- Among renewable fuel suppliers the prevailing view is that enough waste feedstocks are available to meet the potential need of 2bn litres and several stakeholders provided quantitative estimates of available feedstocks.
- Fossil fuel suppliers share concerns that the incremental volume may not be commercially available in the market.
- At least five renewable fuel suppliers and one consultancy expect the buy-out price may be breached before 2020 and suggest that the buy-out price should be increased from 30p per certificate to 40p or 45p per certificate.

Government response

7.60 The consultation responses have been very helpful in confirming that the required volumes of waste feedstocks are likely to be available. For the post-consultation CBA, we continue to assume that the required waste feedstocks can be supplied.

7.61 We recognise that there is a risk of the buy-out price being breached. However, given the post-consultation amendments to the amount of crop-derived fuels being eligible for RTFCs as well as the increased target for development fuels, we consider that this risk is now reduced for the fuels supplied under the main obligation.

Q49: Do you have any additional evidence regarding expected future supply cost of renewable fuels, and specifically of waste biodiesel?

Summary of responses

Total	Yes	No
30	18	12

7.62 Eighteen respondents chose "yes", 14 of these then stated "see Question 48". We received four substantive responses supplied by three Renewable Fuel Producers/Suppliers and one industry representative body and some comments from those who had chosen "no". These responses included the following information:

- A cost estimate for advanced biodiesel that would require a buy-out price of 80p per dRTFC to make the first commercial plant viable, suggesting that the cost would fall for second and third plants;
- Information on a cost target of £100/MWh for electricity from anaerobic digestion by 2020 in 2016 prices of levelised cost;
- Information on the cost of SNG, which is linked to the cost of renewable electricity: the cost of off-shore wind electricity generation has recently dropped from €72.7 to €50/MWh. This supplier expects the cost of P2G (power to gas, i.e. SNG made from renewable electricity) could fall dramatically with large scale deployment;

- A statement of concern that the price of waste biodiesel will rise to the buy-out price if crop biodiesel is limited by a low crop cap, this is based on the argument that:

“Where a “customised” market exists, a premium always comes into that market: For example, high GHG saving ethanol is commanding a premium in Germany to the standard European bioethanol price of over €100/m3 due to low availability. There is a risk that a 2 billion litre guaranteed demand for waste biodiesel with no alternative price setting mechanism will increase the price up to the buy-out where it is more economic for the obligated supplier to buy RTFCs.”;

- One respondent expressed concern that ‘back blending’ could happen, as happened with E85; and
- Several respondents expressed concern that the price of UCO will breach the buy-out price.

Government response

7.63 The cost estimate for advanced biodiesel has been very helpful. In combination with consultation responses to Questions 48 and 51, it has helped us to determine the buy-out price for dRTFCs at 80p per certificate. Regarding the risk of breaching the buy-out price for the main RTFO, we consider this risk to be much lower now, following post-consultation amendments to the policy: primarily the increase in the crop cap but also the increase in the development sub-target over time will ensure that a variety of fuels can be supplied and that the market is not "customised".

Q50: Do you have any evidence of UK refining and refuelling infrastructure that precludes or supports a moderate introduction of E10? How does this compare to other countries such as Germany and France with similar retail forecourt facilities (2 pumps for petrol grades)?

Summary of responses

Total	Yes	No
19	12	7

7.64 We received 19 responses to this question, but very little evidence on refuelling infrastructure.

7.65 There was a common theme of scepticism around the roll out of E10. Seven respondents in particular (three industry representatives, three fossil fuel suppliers and one renewable fuel producer) put forward strong opposition against a moderate introduction of E10. One of the industry representatives and two fossil fuel suppliers claimed a lack of sufficient infrastructure would make it very costly at best or physically impossible at worst to support a moderate introduction of E10. The renewable fuel producer and a fossil fuel supplier touched on commercial issues around customer acceptance, a problem which was highlighted in Germany by many respondents.

- 7.66 A combination of two renewable fuel producers, one industry representative and one consultancy referred to the LowCVP report “Successfully deploying E10 petrol”.
- 7.67 A consultancy highlighted that several Safeway/Morrison sites are configured to take three grades of petrol through segregated underground tanks.
- 7.68 One industry representative and renewable fuel producer cited the implementation strategy used in Finland and Belgium where the number of petrol grades was restrained to two (E10 and E5 – premium legacy grade). They both claimed this would increase uptake, while simplifying the choice for consumers. It was suggested that to avoid a repetition of consumer distrust (as observed in Germany), the UK should follow Belgium’s example for E10’s introduction. In preparation for E10’s introduction on Jan 1st 2017 in Belgium, both respondents highlighted, there was close stakeholder involvement in developing a communication strategy which ensured that consumers would receive accurate and consistent information about E10. Respondents went on to suggest that the UK should introduce E10 as a standard fuel for RON-95 and have one alternative, a premium grade RON-98 with up to 5% ethanol.
- 7.69 Two separate industry representatives raised concerns about the impact on consumers, with one highlighting the reduced fuel efficiency from E10 increasing costs for consumers and highlighted E10’s environmental impacts. Their research suggested reductions in tailpipe CO (carbon monoxide) and CO₂ but an increase in NO_x emissions. The government was urged to assess the performance of E10 from a consumer and environmental perspective, tested under real world conditions.
- 7.70 The other industry representative raised the issue of the “large number” of older vehicles which are not compatible with E10. If E10 were rolled out nationally it is claimed that motorists will be required to use the more expensive super grade. The government was urged here to consider the “financially vulnerable” consumers who are likely to be disproportionately impacted by this.

Government response

- 7.71 The evidence provided by respondents has not clarified whether a full switch to E10 would be required. The CBA continues to assume a 40% uptake of E10 for the central scenario but looks as “no E10” and “high E10” as sensitivity scenarios, since many industry stakeholders consider these scenarios more likely than a moderate E10 uptake.
- 7.72 Introducing E10 to the UK will require co-ordination with industry, and public communication. DfT will work with industry to ensure any potential roll-out of E10 in the UK is carefully planned and handled.
- 7.73 We recognise the need for drivers of older vehicles to continue to have access to suitable fuel in the event of the introduction of E10. We will consult on proposals both to ensure E5 remains available, and for how long.
- 7.74 There is some conflicting evidence with regards to NO_x impacts of E10, though E10 has been shown to have other air quality benefits. We understand that the research quoted by stakeholders showed an increase in NO_x from E10 petrol in aggressive/high-speed conditions. This research has not been published and we do not have access to the underlying data. We understand that the same

research also showed benefits including a decrease in tailpipe carbon emissions.

- 7.75 To put the results into context, NO_x emissions from petrol are very low relative to diesel under real-world driving and are generally closer to their regulatory limits. So in absolute terms a potential increase in NO_x from petrol would only result in a very small increase in emissions overall and E10 petrol would still be significantly lower than diesel.
- 7.76 This research is only a snapshot of the petrol vehicles on the market so does not give a complete picture of the emissions effect from E10. There is considerable variance in their results between models which reflects the fact that the impact on emission from E10 will very much depend on how the vehicle has been tailored to respond to the ethanol content of the fuel. The testing is also subject to the variances in driving style, climatic conditions and measurement accuracy. Whilst steps were taken to mitigate these factors it would have given more rigour to the outcome if some laboratory testing had been completed to give assurance through truly accurate and repeatable results.
- 7.77 Note that E10 has been the mandated reference fuel for vehicle testing of fuel consumption and emissions since March 2016 and this will be extended to all cars on sale in the UK in August 2018. Therefore, newer cars are more likely to be tuned for E10 so should see no adverse impact from the fuel. This was reflected in the testing quoted by stakeholders, which saw worse results with the older vehicles.
- 7.78 Other work undertaken in 2011 by the DEFRA Air Quality Expert Group concluded that E10 petrol will have no change in oxides of nitrogen (NO_x) emissions but would lead to a reduction in the other regulated pollutant emissions; carbon monoxide (CO), hydrocarbons (HC), and particulate matter (PM). The Air Quality Expert Group also concluded that the reductions in emissions may be more apparent for older vehicles.
- 7.79 In advance of any decision to introduce E10 we are carefully considering the evidence on air quality impacts and will work with industry to determine what technical testing and assessment may be needed to provide assurance on impacts on fuel consumption and air quality. We are also actively considering undertaking our own testing to verify the impact on air quality and will publish more details on this issue in due course.

Q51: Do you have any evidence on the supply cost of waste-derived drop-in fuels that can be used either in aviation or in diesel (in excess of B7, still meeting the diesel standard EN590)?

Summary of responses

Total	Yes	No
20	2	18

- 7.80 Substantive responses to this question came from one consultancy and one renewable fuel producer/supplier.
- 7.81 The most relevant answer received to this question came from a renewable fuel supplier. They have shared evidence to show that a waste biodiesel or bio-jet plant in the UK using the gasification / FT route would require a buy-out price of at least 80p per dRTFC.
- 7.82 The other substantive response was from a consultancy and stated that a supermarket chain had previously developed B30 biodiesel that fully met the requirements of EN590 as a forecourt grade with a range of existing companies as customers. They also stated that bio-LPG should be included in the development sub-target, a direct secondary fuel when HVO biodiesel is manufactured.
- 7.83 Several fossil fuel suppliers marked this as a "No" and then stated that HVO has already been sold in the UK market (8 million litres in 2015/16, RTFO Year 8) which suggests this could sometimes be competitive with FAME and/or RTFCs. However, they expect that HVO will command a premium over FAME and that its deployment and price premium will depend on the capacity available and the penalties for non-compliance in different European markets.

Government response

- 7.84 To reflect the high initial supply cost of development fuels, we have increased the cost estimate for advanced fuels in the CBA. For the first two years of the development sub-target we use the "High cost" estimate also for "low" and "central" cost estimates for development fuels only. We expect that competition between suppliers will bring down supply costs for development fuels after the initial two years.

Q52: Do you expect to see any significant changes in the share of renewable fuels used in non-road mobile machinery? Can you provide any evidence of these changes?

Summary of responses

Total	Yes	No
15	8	7

- 7.85 We received eight substantive responses to this question. Three fossil fuel suppliers and one industry representative replied with 'yes' and were of the view that a likely increase of biofuels levels in Gasoil 10ppm will increase the risk of fuel quality and safety issues.
- 7.86 Three respondents suggested that biopropane be added to the development fuels sub-target as this would help renewable fuel supply increase in this sector.
- 7.87 Two industry representatives believed the current proposals offered in the RTFO will have a negligible impact on the RED target, with respondents going further to suggest renewable fuels should be made to be more attractive than the red diesel alternative. This was the view echoed by a consultancy firm who

believe that the lower fuel duty rate of red diesel made it the preferred fuel unless legislated otherwise.

- 7.88 One fossil fuel supplier and renewable producer agreed that there were benefits to be had from using HVO in NRMM. The fossil fuel supplier went on to suggest the use of rebated (unmarked) diesel, crediting end users directly for the duty differential between road diesel and gasoil. An approach however that would only be viable for high-volume users (of which there are few) and could introduce compliance risks and fraudulent behaviour.
- 7.89 A fossil fuel supplier provided evidence on the increasing use of biopropane in road transport by stating that in 2017 up to 20,000 tonnes of biopropane, equalling 24% of all LPG used in UK road transport, will be imported to the UK from the HVO production plant in Rotterdam. The amount of biopropane they believe available in Europe could increase quickly with the commercial deployment of gas conversion expected in 2017. On LPG's use in NRMM, they stated that there is already an established demand for it, with notably a third of fork lift trucks running on it.
- 7.90 Two fossil fuel suppliers expressed their reluctance in having to blend high levels of FAME into gasoil in order to meet the 9.75% obligation across petrol, diesel and gasoil volume in 2020. They cited safety risks as one of their main concerns.
- 7.91 One renewable fuel producer highlighted that train operators still require zero FAME gasoil/diesel and believes the rail sector should be utilising 7% blends at least and preferably high bio-blends.
- 7.92 Finally, an academic acknowledged the difficulty in decarbonising a sector such as agriculture but suggested there should be greater focus on developing alternative types of agricultural machinery such as battery powered machinery.

Government response

- 7.93 We have not received any evidence that would suggest a significant change in proportions of NRMM relative to petrol and diesel. Assumptions in the CBA remain unchanged. We continue to assume that renewable fuels are only blended into petrol and road diesel and not gasoil.

Q53: Do you have any additional evidence regarding expected deployment of gas-powered vehicles and likely future demand for biomethane as a transport fuel?

Summary of responses

Total	Yes	No
30	10	20

- 7.94 We received ten substantive responses to this question. A combination of an industry representative (one) and fossil fuel suppliers (three) urged caution around the UK picking renewable fuel “winners” and urged for the market to develop solutions. Respondents here cited previous artificially imposed

infrastructure projects that did not have a good track record, e.g. the UK's LPG initiative that resulted in an estimated £150 million sunk cost for retailers who invested in equipment on the assumption that LPG's popularity would grow via government subsidies. They went on to say that the government, on the behalf of the taxpayer, invested £150 million in grants and duty incentives but brought the programme to a close after the environmental benefits between LPG and road fuels became less apparent (due to fuel and vehicle technology improvements). Consumers who had paid for converting their vehicles and service station owners who had invested in storage and refuelling equipment both lost out.

- 7.95 A fossil fuel supplier cited the USDA FAS 2016 report which states that in 2014 the total EU consumption of purified biogas for transport of 134 MT of oil equivalent is marginal, with the majority of biogas instead being used to generate electricity and/or heat.
- 7.96 An NGO stated that the climate benefits of using natural gas were non-existent or questionable at best. Upstream emissions of natural gas are thought to make it especially problematic. This respondent stressed that natural gas should not be seen as a solution for light duty vehicles as electrification is more credible.
- 7.97 One fossil fuel supplier saw a future role for natural gas and biomethane as transport fuels with the greatest potential as a liquefied fuel for ships and long distance HGVs. In contrast they did not expect a significant penetration of natural gas and biomethane in the light duty vehicle sector.
- 7.98 One fossil gas supplier made reference to the Element Energy report 'The case for biopropane in transport'.
- 7.99 A consultancy stated that natural gas/biomethane trucks were already widely used around the globe, namely the US, and that the supply of trucks will migrate to Europe. The same point was made by an industry representative who stated that under the right conditions by 2025, biomethane gas engines could account for 25-50% of the HGV vehicle market. While another fossil fuel supplier expected the number of gas vehicles to double between 2020 and 2030 with government support.
- 7.100 Two industry representatives mentioned the large GHG savings that could be achieved with the use of biomethane. One representative in this case believed that biomethane used in advanced dedicated spark-ignition engines for large goods vehicles would be most effective.
- 7.101 One renewable fuel supplier recommended reviewing the research of New Holland, who play a significant role in investigating and promoting a sustainable future for agriculture including the role of biomethane powered farm vehicles.
- 7.102 A hydrogen supplier made reference to the projections for hydrogen cars for the period to 2030 by the UKH2Mobility project.
- 7.103 Finally, a renewable fuel producer believes biomethane can play a significant role in decarbonising the UK HGV sector and expects the deployment of dedicated gas-powered HGVs to increase from 2017 onwards. They have secured a supply of unsupported biomethane that is sufficient to fuel 100-150 dedicated CNG long haul HGVs. They went onto state that they believe the electrification of the HGV sector on a meaningful scale is likely decades away. While the UK's natural gas pipeline is a world class asset that has already been paid for and is operating with spare capacity.

Government response

7.104 We have not received sufficient evidence to change assumptions around the uptake of gas-powered vehicles in the CBA.

Q54: Do you agree that the impacts of proposed operational changes listed in table 7 and covered by Sections 2, 3, 4 and 5 of the consultation document are relatively minor? Do you have any evidence that would help us identify and quantify impacts of any of these amendments?

Summary of responses

Total	Yes	No
28	17	11

7.105 We received 28 responses to this question. Fourteen respondents across a number of sectors (one fossil fuel supplier, eight renewable producers, three industry representatives and two waste recycling companies expressed concern around the introduction of the waste hierarchy and definition of waste (points 1-3 in, table 7), and the removal of rewards for renewable fuels created using precursor fuels already rewarded under another Member State's incentive scheme (point 9, table 7). One renewable fuel producer stated that if the Government intends to make new and conflicting interpretations on the status of wastes included in the RTFO List of Wastes and Annex IX of the RED and ILUC amendments, it would contradict the requirements of implementing the RED and ILUC Directive. This would have serious negative consequences for the UK in the form of:

- An insecure investment environment;
- Increased costs to meet the RTFO; and
- Loss of highly skilled jobs.

7.106 A biofuel producer believes that whichever stock is defined as eligible for the development fuels sub target can have potentially high impacts.

7.107 Three fossil fuel suppliers and one industry representative thought the proposed operational changes were major, with reference to the suspension of the RTFC carryover from 2019 to 2020.

7.108 If the question however is in reference to table 7 in the main consultation document (renewable hydrogen) then the impacts seem likely to be small. The four respondents in this case cited that the Transport Energy Taskforce had already established that the 2020 target will already be difficult to achieve and that the removal of the carryover option will add further difficulty and does not benefit the UK's climate change efforts over the long haul.

7.109 One fossil fuel supplier highlighted the uncertainty associated with any impacts, explaining that several of the changes will result in additional compliance costs, which would be passed on to the consumer, and may have a more significant impact than previously expected.

7.110 One renewable fuel producer and industry representative supported the application of the waste hierarchy to determine which fuels qualify for double

counting and the new development target. However, they both believed that further clarification will be required when the waste hierarchy test is applied to singled counted materials which do not qualify under the development fuels sub-target. They stated that the reward for all biofuels should be based on energy content, with the industry representative going further to say that for gaseous fuels the level of reward and therefore multiple counting is calculated on an energy basis. Finally, both agreed that support in all third countries should be taken into account as this is a commonly accepted principle which should be preserved and applied to all schemes, not only in the EU but also in all third countries.

Government response

7.111 We have not received sufficient evidence to amend the CBA

Q55: Do you have any evidence on the impact of proposed changes to RTFC carry-over in 2020?

Summary of responses

Total	Yes	No
22	8	14

7.112 We received twenty-two responses to this question, eight of which were substantive. From those respondents who replied with “yes” there were two common themes when reading through the comments and evidence.

7.113 One industry representative and four fossil fuel suppliers (repeating points made in Question 54) highlighted again the difficulty in achieving the 2020 target, and added that the removal of the carryover option will not benefit the UK’s climate change efforts over the long haul. One of the three fossil fuel suppliers said that the 2020 carryover exemption could negatively disrupt certificate trading and add costs to the consumer. They estimated that over a 3-4 year period (from 2018) more biofuel blending would take place if the carryover were to be permitted into 2020 than if the carryover was not permitted.

7.114 One industry representative and two renewable fuel suppliers (all answered yes), stated that if the carryover remained at 25% and all development fuels are issued with double certificates, then the UK risks losing out on increasing the amount of carbon saved by allowing such a high carry over. They believe that high carryover does not cater for seasonal uncertainties in the biofuels supply chains and biofuel investors would benefit from lower carryover. One renewable fuel supplier and the industry representative suggested that carryover should be reduced to 20% with the other renewable fuel supplier suggesting 10%. All three agreed the carryover should be reviewed for the post 2020 period, depending on the market for development fuels.

Government response

7.115 We have not received sufficient evidence to amend the CBA.

Q56: Do you have any additional evidence that you consider relevant to this cost benefit analysis?

Summary of responses

Total	Yes	No
22	11	11

7.116 We received 22 responses to this question, 11 of which were substantive.

7.117 Five respondents, one industry representative and four fossil fuel suppliers, acknowledged that the RTFO buyout facility had “done its job well”. They expressed concern however that the requirements for targets in the FQD could impact the value of a RTFC. Citing the work done by the Transport Energy Task Force, they believe it is clear that by 2020 suppliers will be short of CO₂ credits, therefore, any CO₂ credit attached to a RTFC will have a value at around the marginal abatement cost for UERs/buyout. As a result, they claim that the RTFC market may increase significantly above the current level and consumers may be exposed to higher costs than intended.

7.118 This group of respondents offered two solutions:

- CO₂ buyout should be reduced more in line with the current market level; and
- The RTFO buyout price, 30 pence per certificate, was intended to be a buyout of a “litre of biofuel” and therefore that fuel has a CO₂ credit attached to it. This could be retained at a fixed percentage at a typical average level of say 60-70%. A change to the existing regulation would allow this.

7.119 In addition to this there was a wide range of additional evidence presented by respondents. This includes two consulting firms who raised separate issues around how RTFCs are awarded and the justification for the amount of pounds per tonne of CO₂ saved.

7.120 In relation to the award of RTFCs, the consultancy here believes that each RTFC was issued for 100% carbon saved instead of against the volume or weight of fuel generated. For example, if a biodiesel product gives a 70% saving then 1 litre would get 0.7xRTFC or 1.43 litres = 1 x RTFC. The benefits from this they believe would be:

- Anyone buying a certificate would know they all have equal carbon saving status;
- The government would know much more clearly and easily how much carbon was being saved; and
- It would drive biofuel producers to maximise the carbon savings potential of their manufacturing process thus maximising the carbon savings potential.

7.121 The other consultancy questioned why the CBA only looks at the relative costs of options to meet the RED Directive (and the long term UK policy of

biofuels) as opposed to looking at the absolute cost benefit case of the renewable fuels proposals. They commented that in the EU Emissions Trading System, the average carbon cost since 2012 has been approximately €6 per tonne of CO₂ saved. The RED, they claim, assumed an average carbon cost of €50 per tonne of CO₂ saved (EC2008), yet the current UK buy-out price of 30 pence per certificate equates to costs of £600 - £700 per tonne of CO₂ saved. From the consultation they also referred to the “even higher” buy-out price of 60ppl for development fuels and asked “where is the business case to justify the UK spending £600-£700 (or £1300) per tonne of CO₂ saved on biofuels after 2020 (or development fuels priced at 60p per litre)?”

- 7.122 One renewable fuel producer queried why a higher crop cap was not implemented as they believed this would lead to substantially higher carbon and financial benefits. Their rationale was that if the double counting benefits of waste based fuels continues to be economically beneficial compared to crop based fuels, we would not see crop based fuels entering the mix at the expense of waste based fuels with a higher crop cap. As a result the industry will reap the benefits from a higher crop cap in a market of available waste biodiesel.
- 7.123 Another renewable fuel producer went into detail describing the gas to liquid process, and Fischer Tropsch (FT), saying that FT fuels are fully compatible with existing infrastructure and engines as there is no blend wall and deliver significant improvements in emissions.
- 7.124 The final group of respondents were two fossil fuel suppliers. One questioned the reduced flexibility afforded to obligated suppliers to meet the already challenging RTFO target of 9.75% in 2020. They stated that the actual volume of renewable fuel blended, and therefore the GHG reductions, will be the same regardless of whether the 9.75% target is met through physical blending of renewable fuel in 2020 or carryover of up to 25% RTFCs from 2019 to 2020. They believe the proposal will result in increased compliance costs for fuel suppliers without actually resulting in any societal benefit. This supplier supports option 0 (no change – carry over permitted as now, obligation reaches 9.75% in 2020), claiming this will allow for supplier flexibility and eliminates additional costs for meeting the RTFO. The supplier does not support the other options, in particular options 1 and 2, which they claim would impose an increased RTFO obligation in order to maintain carryover which would carry unacceptably high associated costs to fuel suppliers in their opinion. The respondent also highlighted the importance of future rules surrounding UER credits in the UK and member states if there are insufficient GHG credits available for fuel suppliers.
- 7.125 Finally the other fossil fuel supplier pointed out that the vast range from the outputs confirmed uncertainty around the subject. They supported the objective of saving GHG but urged caution that economic development was not compromised as a result.

Government response

- 7.126 We have not received sufficient evidence to amend the CBA.

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