THE ASSOCIATION FOR RENEWABLE ENERGY & CLEAN TECHNOLOGY

REA Gasification and Pyrolysis Meeting

9th December 2021

Mark Sommerfeld
Head of Power and Flexibility, REA

Agenda

Review of Actions from last meeting

- *Last meeting was focused on the EA Ricardo AEA Gasification Review – views on which have been fed back to the EA.*

Policy Update

- *Net Zero Strategy*
- *Biomass Policy Statement*
- *Hydrogen Strategy*
- *Industrial Carbon Capture Contract*
- *CfD*
- *EBA 'EBA paper: 'Gasification - A Sustainable Technology for Circular Economies'*

BEIS update with input from Charlotte Powell, BEIS Head of Bioenergy and Carbon Removals

- *BEIS Advanced Gasification Technologies Review and next steps*
- *BECCS Hydrogen Net Zero Innovation Competition*

Update on EA Regulatory Issues

- Update on EA '*Establishing a methodology that supports the assessment of the impact of ATT Processes'*
- Update on permitting Delays
- Waste Incineration BREF implementation

Legal Update **(Hilary Stone)**

- *Waste Shipment Regulations*

Discussion: Priorities for 2022

- *Setting out priorities for the working group in 2022*

Date of Next Meeting

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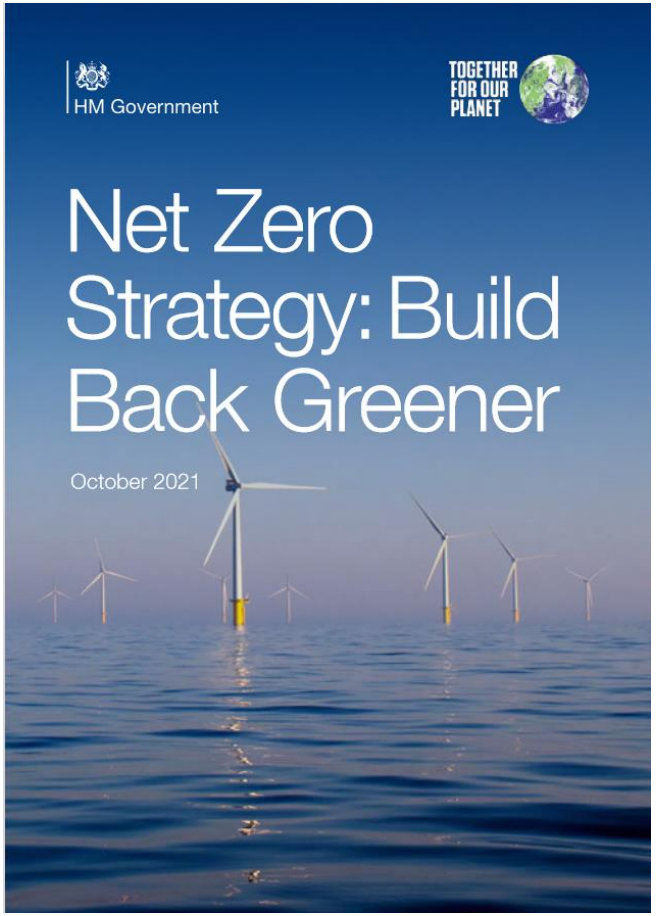
Policy Update

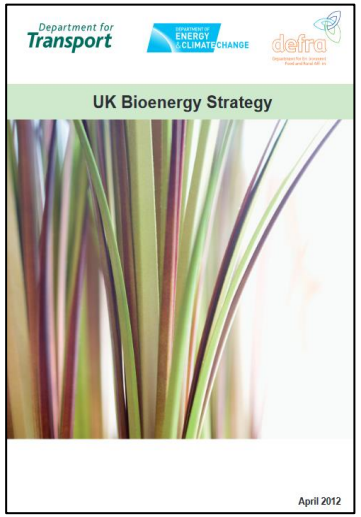
Net Zero Strategy – *Some select highlights*

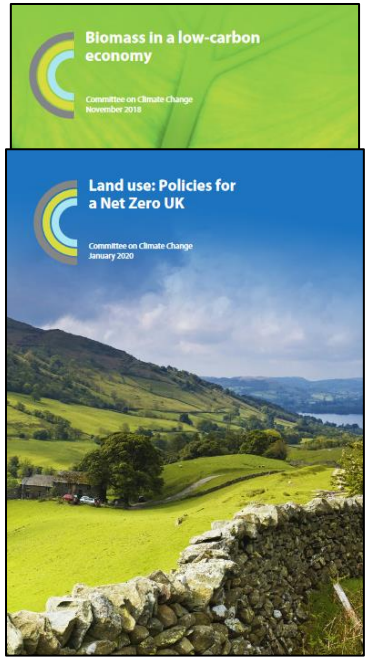
- Formal inclusion of the target for **decarbonised electricity** by 2035
- **Kickstart zero emissions international travel**
  - Ambition to deliver 10% **Sustainable Aviation Fuel** by 2030 - £180mn funding for developmental SAF plants
- 5GW of **hydrogen** capacity by 2030
- Deliver four **carbon capture usage and storage** (CCUS) clusters, capturing 20-30 MtCO2 across the economy, including 6 MtCO2 of industrial emissions, per year by 2030
- Ambition to deploy at least 5 MtCO2/year of engineered **Green House Gas Removal Technologies** by 2030.
- £1.5bn **net zero innovation portfolio**
- £75 million on net zero related **R&D across Natural Resources, Waste & F-gases**, to inform our pathway to 2037.
- Near elimination of **biodegradable municipal waste to landfill from 2028.**

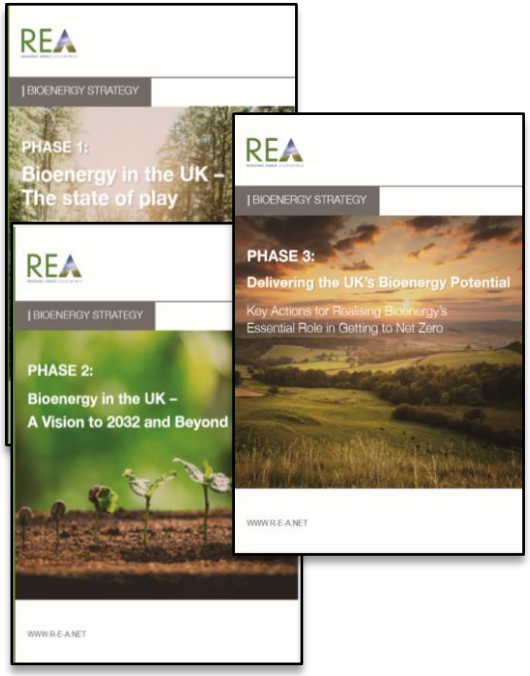


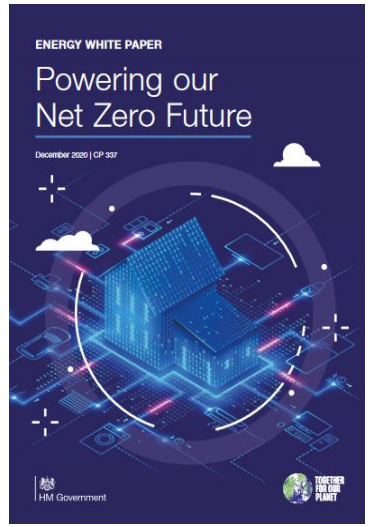
A New Biomass Strategy for the UK in 2022

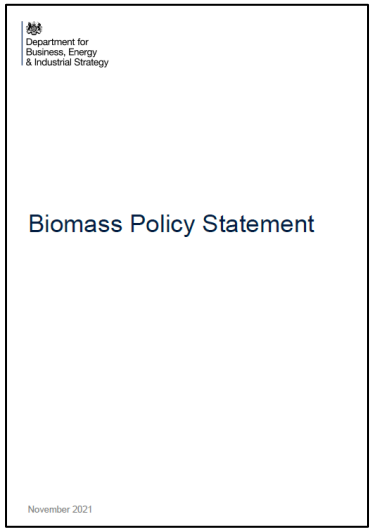
"There is widespread acceptance that biomass, including bioenergy with CCS and energy from waste, has a key role to play in achieving net zero. The question is where and how biomass is best used to deliver on our targets – whether that is for generating electricity or other purposes."
BEIS, Government Response to Committee on Climate Change 2020 Progress Report to Parliament.











Biomass Policy Statement – BEIS, Nov. 2021

"Gasification has been identified as a key area of innovation, as it could provide a route to gain flexibility in both feedstock use, and useful products."

"Recognising that sustainable biomass is a limited resource, it is important to ensure that biomass is prioritised within the economy where it offers the greatest opportunity to reduce greenhouse gas (GHG) emissions in 'hard to abate' sectors"

Hierarchy of best use for sustainable biomass resources

Between now and 2050, the current uses of biomass in the UK need to change:

	Most effective use today	2020s and 2030s	By 2050
Bioeconomy	Wood in construction	Wood in construction, potentially other long-lived bio-based products (within circular economy)	
Buildings	Biomethane, local district heating schemes and some efficient biomass boilers in rural areas		Only very limited additional use for buildings heat: niche uses in e.g. district heat and hybrid heat pumps
Industry	Biomass use for processes with potential future BECCS applications		BECCS in industry alongside other low-carbon solutions
Power	Ongoing use in power sector in line with existing commitments or small scale uses	Demonstration and roll out of BECCS to make H_2 and/or power	Biomass used for H_2 production or power with CCS
Transport	Liquid biofuels increasingly made from waste and lignocellulosic feedstocks	Liquid biofuel transitioning from surface transport to aviation, within limits and with CCS	Up to 10% aviation biofuel production with CCS

Maximising abatement means using biomass to sequester carbon wherever possible (opportunities to do this will increase over time)

Advanced Conversion Technologies Required Predominately for Hydrogen Production and SAF

Source: CCC (2018) Biomass in a Low Carbon Economy

Sector	Key biomass technologies in a low carbon economy (UK Biomass Statement, November 2021, REA interpretation)
Power	• Biomass power only with CCS (BECCS) • Energy from waste with CCS
Heat	• Solid biomass and liquid biofuels (e.g. HVOs or bio-LPG) only in hard-to-electrify properties (e.g. rural, off the gas grid) subject to meeting sustainability criteria and air quality rules • Biomethane from AD to decarbonise gas grid in the near term (gas boilers, hybrid heat pumps) • Biomethane from advanced gasification may play a role subject to becoming commercial • Heat networks (biomass CHP, Energy from Waste) to meet 18% of heat demand by 2050 • Role of [bio]hydrogen in heating uncertain until 2026 (from advanced gasification or biomethane reformation)
Industry	• Biomass only with CCS (BECCS), or in hard-to electrify applications, subject to meeting sustainability and air quality rules • Biomass use in high temperature fuel switching applications • Biogas used for direct combustion or CHP (where site is off the gas grid) • Biohydrogen from advanced gasification and biomethane reformation • Heat networks (biomass CHP, Energy from Waste)
Transport	• By 2050 all biofuels directed to aviation (hard- to decarbonise), produced with CCS • Sustainable Aviation Fuels used to decarbonise aviation • Gaseous and liquid biofuels still playing a near term, transitional role in road transport (demand expected to decrease with transport electrification, though HGVs may rely on them for longer)

Hydrogen Strategy

Hydrogen Business Model in Development

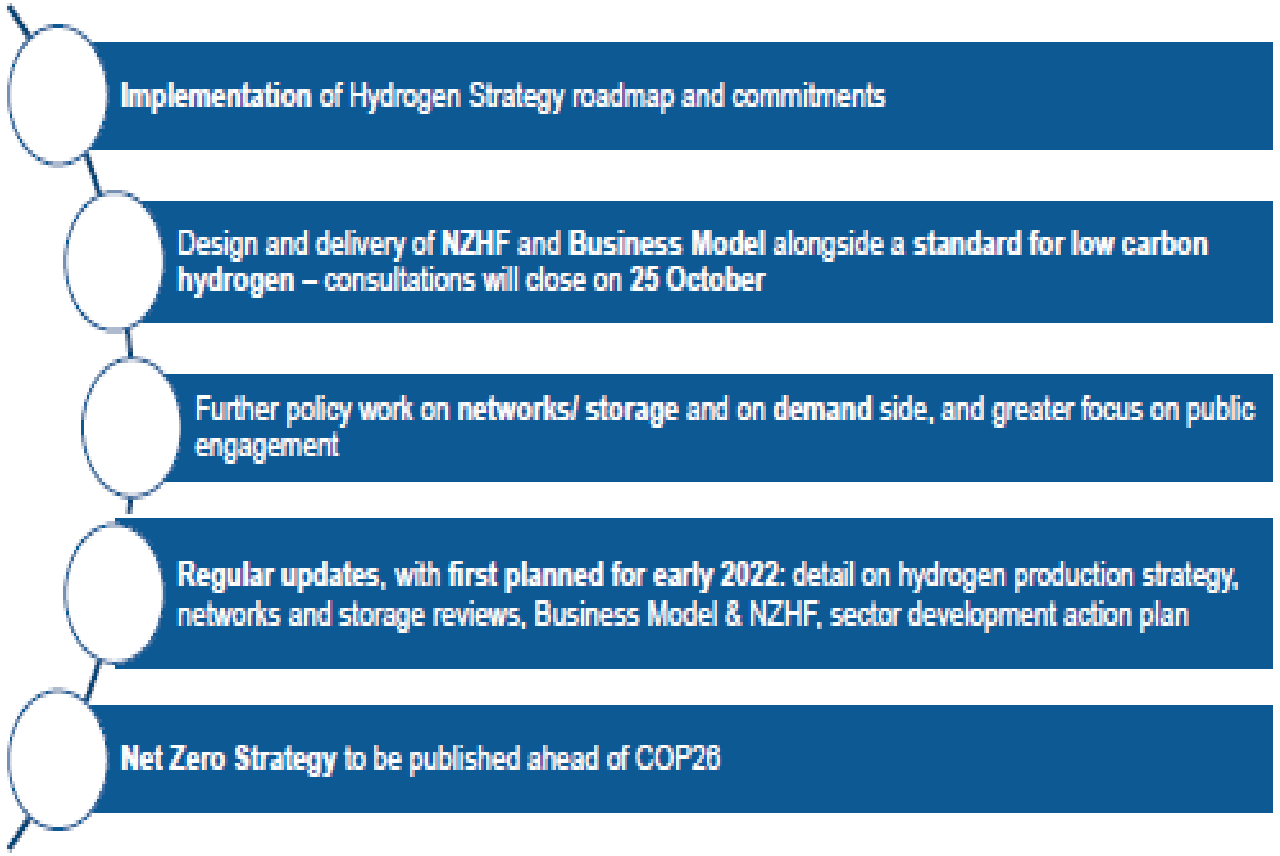
‘Minded to position’: producer led revenue as opposed to end user model, across range of production technologies and end use sectors.

Multiple production routes including main routes but also other pathways (biomass gasification + CCS)

No restrictions on end use / applications

‘Minded to position’: private law contract as opposed to policy based or economic regulation

Accompanied by NZ Hydrogen fund and Standard for Low Carbon Hydrogen.



Industrial Carbon Capture Contract

Government developing Business Models for Carbon Capture and Storage in industrial applications as part phase 2 of CCUS Cluster sequencing. Energy from waste, including ACT, confirmed as eligible.

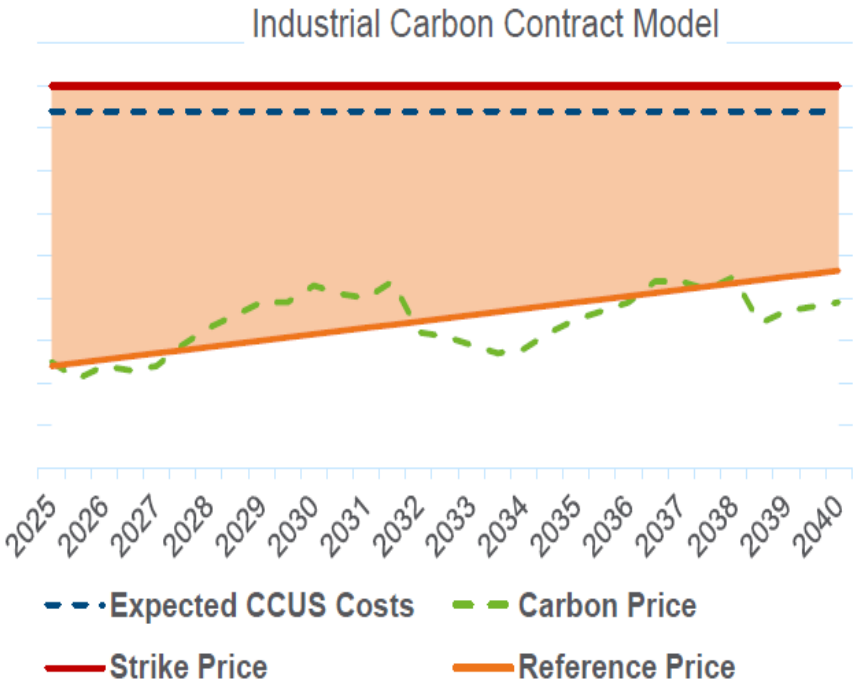
A 15 year ICC contract that provides emitter with a payment per tonne of captured CO2, intended to cover operational expenses, Transport and storage fees and repayment of, and a rate of return on, capital investment in carbon capture equipment.

Strike price will initially be negotiated bilaterally for FOAK projects, with intention of moving to competitive allocation.

Expressions of Interest already closed, but BEIS open to consideration

Modifications to ICC contract likely needed to consider

- Avoid any form of perverse incentive that could alter the composition if the waste stream (such as undermining the waste hierarchy)
- understanding how to avoid over-subsiding projects if a negative emission market becomes established
- how the contract would need to change if carbon pricing was applied to the sector at some point in the future.



Contracts For Difference: Allocation Round 4

Contracts For Difference: Allocation Round 4

- Opens 13th December 2021
- Interested projects must have registered on the ESO website in advance.
- Pot 2 (less established technologies) now includes: ACT, AD (>5MW), dedicated biomass with CHP, floating offshore wind (see following section), geothermal, remote island wind (>5MW), tidal stream, wave
- For the delivery year 2025/6 and 2026/7
- £55m per year for Pot 2 (with £24m ring-fenced for floating wind power, and £20mn for tidal stream)
- ACT Administrative Strike Price of £190/MWh

EBA paper: 'Gasification - A Sustainable Technology for Circular Economies'

Report provides an overview of the history and technology readiness, along with the potential it has for contributing to decarbonisation in an EU context.

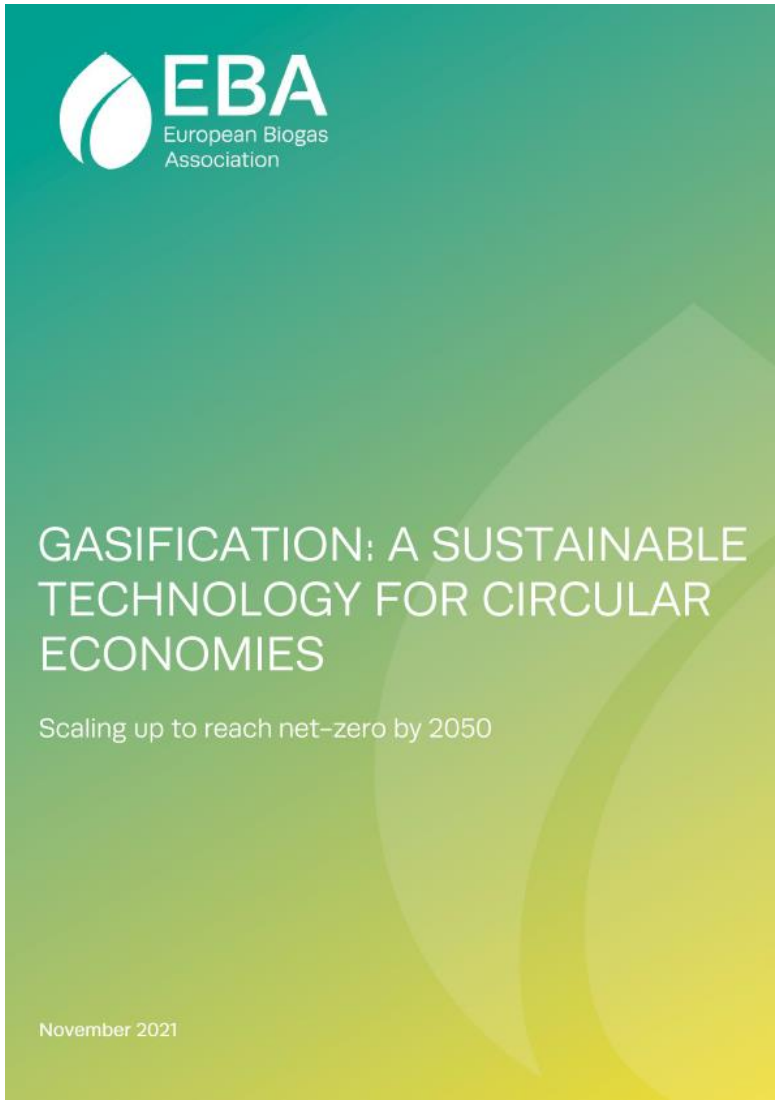
Provides a review of all possible products that are could potentially be produced by gasification.

It also focuses on the additional benefits provided by gasification beyond energy and sanitation provision, particularly Biochar products.

EU market for gasification of fossil, biomass and waste resources was valued $479bn in 2019 and is projected to reach $901bn by 2028.

Places current break-even price of average SNG production at 85 Euro/MWh, to be 59 Euro/MWh by 2030s.

Calls for an escalated carbon price through the EU ETS to support deployment.



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BEIS update with input from Charlotte Powell, BEIS Head of Bioenergy and Carbon Removals

Government Reviewing the Status of the Technology

BEIS Publish Advanced Gasification Technologies: Review and Benchmarking Report

AECOM and Fichtner Consulting commissioned to produce the report, with the aim to focus on the conversion of waste or biomass into aviation fuel, diesel, hydrogen, methane and other hydrocarbons.

Report suggests that none of the AGT technologies reviewed were currently in commercial operation. Although did not consider electricity production.

Technology readiness levels of those reviewed varied between levels 6 – 8 (demonstrated but not commercial).

"The primary opportunity for AGTs is as a means of producing low carbon hydrogen and hydrocarbon products. Use of biomass or waste feedstocks give AGTs with CCUS the potential to be one of a limited number of technologies available for operating with a net negative release of CO2."

Further Study now focused on 'Next Generation Carbon Capture Technologies – Application of Next Generation Technologies'

Task 4: Opportunities and Barriers

"In the last 20 years, more than 30 gasification projects using waste or biomass have been developed in the UK, with assistance from a variety of government support mechanisms. All these projects were intended to produce electricity. However, many of these projects have never been successfully commissioned, did not perform in line with initial expectations, or only operated for a limited period of time."
BEIS, 2021, Advanced Gasification Technologies – review and Benchmarking

Range of Issues and lessons learnt identified:

- Complex process plants that contractors find difficult to deliver
- Feedstock variability
- Scaling up from demonstration is difficult.
- Development of projects based on support mechanisms that may otherwise have not had a favourable business case
- Ineffective support mechanisms that have driven power production over other outcomes and infrequent CfD auctions.

Task 4: Barriers

Table 2. Barrier Classification

Barrier Description	Category
A potential barrier to the large-scale deployment of AGTs in the UK.	
A potential barrier to large scale deployment of some AGT configurations prior to 2035.	
In isolation, unlikely to prevent deployment of well-developed AGT configurations prior to 2035.	

Table 3 Barriers to AGT Deployment

Barrier	Comment	Category
Economic Barriers		
Government incentives	Level of support required, and time required to develop incentives for low carbon products and CO_2 capture.	
Competing technologies for CO_2 emissions reductions	The potential availability of simpler, lower cost CO_2 emission reduction options.	
Competing technologies for producing low carbon products	Competition from other technologies capable of producing low carbon hydrogen and other low carbon products.	
Competition for feedstock	Biomass and waste are limited resources with other uses. Many other uses of biomass and waste have their own positive environmental impacts.	
Product price volatility	Market prices of AGT products are volatile and unpredictable.	
Availability of finance	The perceived risk of gasification may influence the future cost and availability of finance for AGTs.	
Technical Barriers		
Plant availability	Achieving an acceptable balance between equipment cost and availability. Availability is dependent on many of the factors listed below.	
Reliable process unit operation	Development of reliable process units for all process stages.	
Scale-up	The cost, time and technical challenges associated with scale-up.	
Full chain integration	Demonstration of full chain operation from feedstock reception to product output and CO_2 capture (if applicable).	
Requirement for CCUS	Some AGTs may require CCUS to provide CO_2 emission reductions. CCUS infrastructure will take time to develop and adds additional cost and complexity to the project.	
Efficiency of conversion	Mass of product output per unit of feedstock is fundamental to the viability of AGTs.	
Feedstock flexibility	Achieving an acceptable balance between grade of feedstock that can be processed and cost of equipment.	
Product quality	The ability to reliably produce products of the required specification without incurring excessive equipment costs.	
Safety	Effective management of process safety in a process with varied hazards.	
Non-Technical Barriers		
Reputation of gasification	Poor reputation of gasification among stakeholders including, contractors, financiers and planning authorities. Potential for public perception issues due to underperforming projects.	
Planning and Permitting	Time required to develop large infrastructure projects, particularly an issue for waste processing plants.	
Dissemination of lessons learned	Openness in relation to sharing lessons learned from underperforming projects.	
Skills	Availability of suitably skilled and experienced staff, and organisations at all stages in project delivery.	

Hydrogen BECCS Innovation Programme

Part of the Net Zero Innovation Portfolio.

Will provide funding for funding feasibility studies (Stage 1) and demonstration plants. (Stage 2)

For TRL 4 to 7, from Lab validation to demonstration.

Expected to launch next year with £5m (max £250k/project) for feasibility studies in 2022/23 and £25mn (max £5mn/project) for demonstration 2023-25.

Funding only provided for hydrogen generation from biologically derived sources.

Application deadline expected to be March 2022 (but could change).

CATEGORY 1

Feedstock pre-processing: The development of low cost, energy & material efficient pre-processing technologies to treat biogenic (including biomass and waste) feedstocks for use in advanced gasification.

CATEGORY 2

Gasification components: The improvement of advanced gasification components, specifically syngas treatment and upgrading for hydrogen generation with CCS.

CATEGORY 3

Novel biohydrogen technologies: The development of novel biohydrogen technologies which can be combined with CCS. E.g. dark fermentation, anaerobic digestion, waste water treatment.

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Update on EA Regulatory Issues

EA Regulatory Framework for ATTs

REA have fed back to EA comments raised in relation Ricardo AEA ''Establishing a methodology that supports the assessment of the impact of ATT Processes" report.

Key Messages:

- Report provides a good foundation for describing ATT processes but cannot be considered authoritative
- Concerns emphasised that this report should not be used prescriptively by permitting officers to determine the design of a project, but that officers should consider the actual environmental outcomes of project.
- Highlighted that the report is largely based on Gasification for power production –not reflective of direction of market.
- Specific concerns raised in relation to how tar wax and metals were treated within the report, demonstrating that in many places reports understanding was out-dated. Reiterating need to focus on environmental outcomes.
- Specific concerns relating to final decision tree and need for clear caveats that this should not be prescriptive.

REA Comments also accompanied by letter from Circular Fuels Limited outlining their specific concerns with the report.

EA still assessing comments and determine how this will feed to into guidance for permitting officers. Updates to be sought in new year.

EA Permitting Delays

REA recently received update on permitting issues through Business Readiness Forum.

- EA are aware of ongoing permitting delays and concerns. Have instigated an Improvement Plan
- In process of recruiting >200 new roles across admin/ permitting and team leaders to help address issue
- Stressed that they where happy to hear from TA's any specific cases where government deadlines were becoming an issues – i.e. commission deadlines to get ND RHI.
- Also emphasised importance on talking with local office and ability to seek local enforcement position.

- End of Waste Panel has reopened in October.

- EA also focused on outstanding Non-compliant sites and tacking stricter action on illegal waste sites.

Waste Incineration BREF Implementation

Best Available Technologies (BAT) published in Dec 2019 – now going through implementation.

Updated BAT implements new Associated Emission Levels (BAT-AELs)

New Plants getting a permits since Dec 2019 have already had new BAT–AEL's
Existing Plants will see new BAT-AELs introduced in permit review – deadline for compliance is **3rd December 2023.**

Information Notice (Reg 61) or Consolidated Variation Notices currently being issued by the EA.

Operators of mothballed/permanently closed sites will be asked intention of what they want to do with their permit.

EA have also published an interpretation document of all BAT conclusions – Available through REA.

Ben Freeman of the EA is running two sessions to go through BAT changes. Second session tomorrow (10th Dec, 14.00 – 15.30). REA Happy to send over details to enable people to join.

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Legal Update

- Waste Shipment Regulations

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Discussion:
G&P Priorities for 2022

Possible Priorities

- Pushing further on regulatory design issues with the EA
- Further awareness raising within Government
- REA Streaming approaches with Renewable Transport Fuel Group, Hydrogen Group and G&P Group
- Informing Biomass Strategy in terms of industry reality and pathway to delivery
- Support mechanism?
- Carbon Capture Business Models?

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Thank You

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